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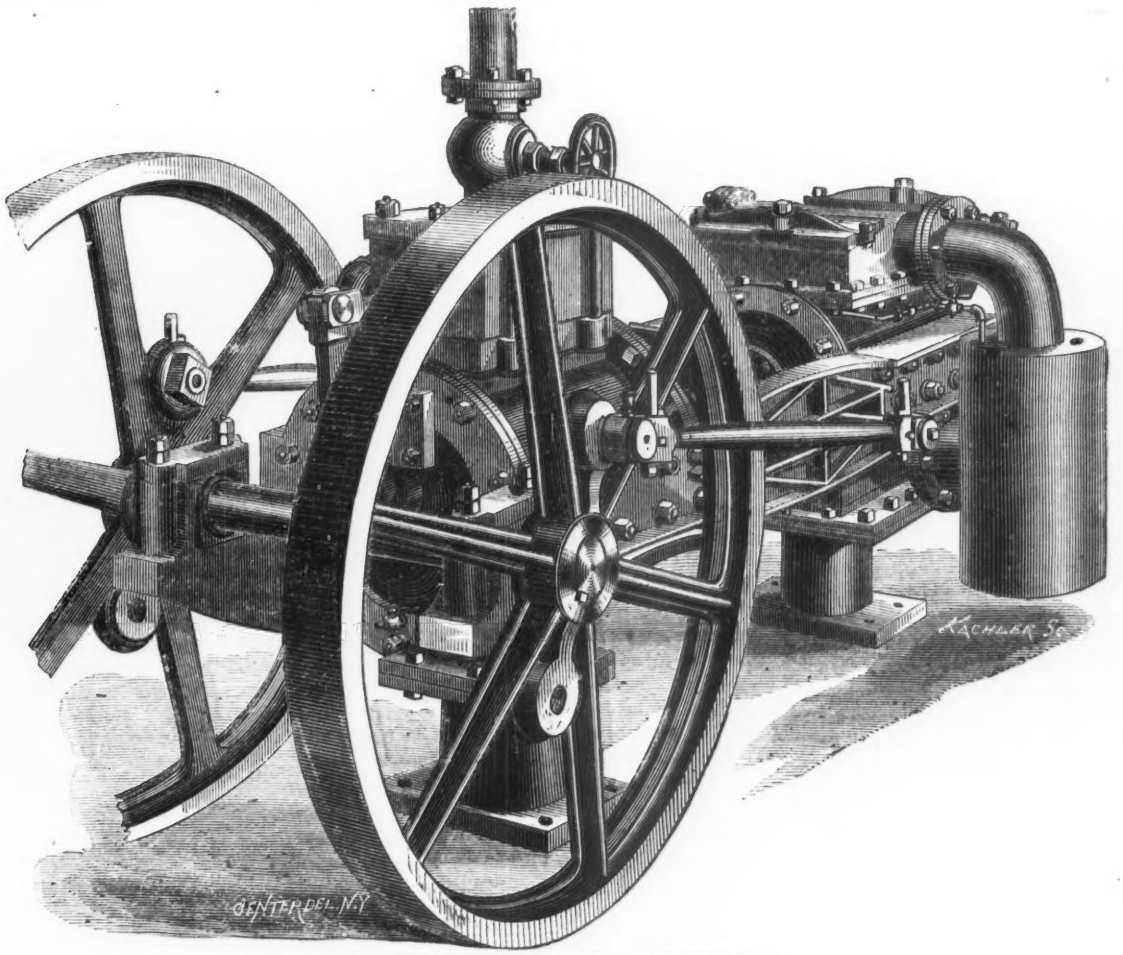
The Improved Niagara Vacuum Pump.

THE accompanying cut represents a fly-wheel vacuum pump, which is especially intended for what is known as a *dry* vacuum pump. It can also be made direct acting in a way similar to the Niagara direct acting steam pump, described in a former number of this journal, and whether fly-wheel or direct acting pump, it is also adapted for use as a wet pump.

Consequent upon the arrangement of its valves, a very quick and sensitive action of the same has been attained; and for purposes where a high range of vacuum is desirable, it would seem this pump should answer, having produced twenty-nine and a half inches upon vacuum gauge. Among the great difficulties hitherto unavoidable in Vacuum Pumps has been the annoying inconvenience of access to the valves and valve-seats, or the impossibility of removal without disturbing the pump, which is attended with much labor, expense and waste of time. In the construction of this pump, these objections are overcome in a very simple and efficient manner, by so constructing the bonnets or covers that they carry the valves, and have the valve-seats arranged in connection with them, whereby on simply detaching from the cylinder of the pump a bonnet or cover, a series of valves, with their seats, is simultaneously removed. The valves are of the kind known as poppet-valves, and are steadied or guided by arranging their stems to play through guide-holes in the valve-seats, and operate in a guiding bar which serves as a base-bar for the valve-closing springs to bear against; this bar rests at each end upon stanchions attached to the valve covers, being secured by nuts. The tank seen on the outside of the pump, is intended to contain water or other fluid as preferred, having, as shown, a small pipe connecting with the valve-chest, by which, at every stroke of the pump, the piston gets lubricated by the liquid from this tank, serving at the same time to prevent heating as well as to fill the space left between the head of the piston and end of the cylinder at each termination of the stroke, and to seal the valves. Should such liquid be admitted in excess of the quantity necessary to perform these offices, such surplus liquid will be discharged through the delivery valves. In the Island of Cuba, where the vacuum pumps form an important element in the machinery of a successful sugar estate, these pumps have been introduced and are now receiving the most flattering encomiums.

This pump is manufactured by Mr. CHARLES B. HARDICK, at the Niagara Steam Pump Works, No. 23, (old No. 9) Adams street, Brooklyn. It is well known that the machinery turned out by these works is distinguished by superior workmanship, durability and effectiveness, as attested by the numerous first premiums which it has received at various exhibitions.



THE IMPROVED NIAGARA VACUUM PUMP.

Polytechnic Association of the American Institute.

LIGNITES OF THE FAR WEST.*

By Prof. J. S. Newberry.

Coal constitutes the main-spring of civilization; and over the western half of our continent our popu-

*A lecture delivered before the Polytechnic Association of the American Institute, April 19, 1872.

lation will be dependent for their fuel mainly upon the beds of lignites of the far West, so that the subject upon which I have consented to say a few words this evening, is one of great practical importance, as well as of scientific interest. Attention has long been called to the existence of these lignites, but very little has been said in regard to any accurate estimate of their value as fuel. A large proportion of the territory where they are found is destitute, to a large degree, of wood. There is much less forest there than in most other parts of the United States. The question, what they shall use there for fuel, is one of special importance. They require fuel, not only for ordinary uses, but for metallurgical purposes.

Our country, as a whole, is better supplied with mineral fuel than any other in the world. We have in the Mississippi Valley several great coal basins, comprising an aggregate area of 150,000 square miles. Great Britain is better supplied with coal than any other country in Europe; and it owes its great wealth and power mainly to its store of fossil fuel. But it is calculated that within three hundred years, in all probability, its store of coal will be entirely exhausted; and then Great Britain must lose the position she occupies and sink to the position of a second, a third, or even a fourth rate power.

The great coal basins of our own country, which belong to the carboniferous age, are altogether found in the Mississippi Valley and on the Atlantic coast. Here you will see upon the map the Alleghany coal field, which reaches 750 miles, from the southern boundary of the State of New York to Alabama, comprising an area of 60,000 square miles. The out-liers of this coal field, separated from it by natural convulsions, are a line of detached basins, containing, in many cases, a semi-bituminous coal. In Rhode Island, and partly in Massachusetts, there is a small coal basin where the anthracite has been partially converted into the condition of graphite. There are coal basins still further north, beyond our limits, in Nova Scotia. There is a small coal basin in Michigan, and there is a coal field in Illinois, and another on the west of the Mississippi, reaching, with irregular outline, from Iowa into Texas, the western border of which is concealed by the overlying rocks.

West of this we have no more carboniferous coal. All the area west of Omaha is without carboniferous coal, and yet there are deposits there of a carbonaceous material that rivals in thickness any of the coal beds. They are all much more modern, being either cretacious or tertiary, within our lines; while south of our lines there are some which are triassic. These are the beds of lignites, or imperfectly formed coal.

I have here a table and specimens of the various kinds, showing the progress of the transformation of wood into coal. The first change is its transformation into lignite, which is another name for fossil wood. Where the wood is covered by something which excludes the oxygen, the loss of material goes on slowly, and the constituents react upon each other, and after a time the wood changes its physical character, although it may perfectly retain its original form. In lignite there has been a loss of some of the constituents of the wood, and they have combined in a new form, making a decided approach towards the condition of coal. Lignites exhibit all the different varieties that we find in coal. In some places the transformation has been more and in others less complete. This specimen from Alaska, where the conversion into coal has progressed rapidly, has an appearance very much like our carboniferous coal, although it is a modern formation.

Cannel coals differ from other coals simply because the circumstances of their formation have been different. Whatever remains you find in cannel coal are typical of aqueous deposition. You will find evidence, wherever the cannel coal is found, that there was formerly an open lagoon, into which there was a leaching of the vegetable tissue which sank to the bottom of the water, forming a carbonaceous mud, which, during the formation of the coal, was constantly saturated with water. The cannel coals are rich in gas, which has a higher illuminating power than that derived from other coal.

The coals that can be burned in the open grate have lost a portion of their volatile matter, but they contain the bitumen, and these are the furnace coals so extensively used in the West.

The next step is anthracite. When the material has been exposed to heat, the volatile matter has been more or less completely driven off, and the residuum is a hard, flinty mass, which has been cemented together by the action of the heat. Coke is the same, excepting that it has not been subjected to pressure, and the gases have expanded it until it has become a cellular mass.

Sometimes not only is the volatile matter all driven off, but the carbon itself is removed, and there remains a larger percentage of earthy matter than in coal; and here we have a graphite tendency, like this specimen, which is from Rhode Island, in which the coal is so nearly converted into graphite that it is almost incombustible. When the process is carried still further, the result is graphite, in which all the bituminous matter and the greater part of the carbon has been driven away, and the substance assumes a peculiarly brilliant condition, with no oxygen and generally a large percentage of earthy matter.

When herbaceous vegetation is acted upon by the conditions which convert wood into coal, we have peat as the result.

The substances that are driven off in the formation of coal are sometimes found stored at a point more or less remote from the coal from which they are derived, as in the case of the coal oil deposits.

To return to the lignites. I have here many typical specimens of them. They contain more than 10 per cent. of water and 16 per cent of oxygen. The oxygen we do not want to buy by the ton, and the water is not only useless bnt it must be converted into steam and driven off. For these reasons the lignites are inferior in value to bituminous coal. Some of them contain so much water that they crack into minute fragments, and there is great loss in mining and in handling them. At Santa Fe there is a lignite which is saturated with water, and so soft that it can be cut with a spade, but it is of no value as fuel. In Sonora there are beds of coal of the triassic age; and there are in that vicinity some small beds of lignite which have been converted into anthracite coal.

The lignites of the far West being of less intrinsic value as fuel than coal, can only be used with economy where they are produced; and they sometimes contain, when taken from the mine; so large a proportion of water that they cannot well be transported. The San Francisco market is supplied from various beds of lignites found in that vicinity.

[Prof. N. exhibited specimens of lignites from Alaska, San Francisco, Denver, Wyoming, Utah, Sonora and other points, with tables showing their constituents, and showing upon the map the locations.]

With regard to the value of these materials as a fuel, we have beds no less extensive than those of the carboniferous period. I have computed from the best data that I could obtain that there are not less than 50,000 square miles of them. They vary very much in value, from the different proportions they contain of oxygen and of water. The quantity of ash is not large, and they contain, on the average, about as much sulphur as our bituminous coal. To determine the calorific power of a fuel, we have simply to make an ultimate analysis of it; and then, supposing it to have the average physical condition, to be sufficiently compact and solid to be handled, to be put into the furnace, and to allow the draft to pass through it, we can determine very nearly its value. To give you the result, without detaining you too ong with the mode of computation, I find that the heating power of these lignites is about five-eighths of that of a good quality of our bituminous coal.

It has been proved that the best coals for making steam are those which have not lost all of their volatile constituents, but which have a long flame. On the average, bituminous coal is about the best standard for all purposes; so that it is a fair estimate of the efficiency of the lignites to say that it is about five-eighths of that of good bituminous coal.

The next question is, whether the combustion is sufficiently rapid, for we have not only the calorific quantity of power but the calorific intensity to calculate. It is easy to determine how much heat it will produce; but it makes a great difference in its value whether you can get out this heat from a given quantity of fuel in five minutes, or whether it takes an hour. For smelting purposes it is necessary that a large amount of heat shall be evolved rapidly. It can best be determined by trial, but I have great confidence that many of these lignites may be burned with sufficient rapidity for the smelting of iron or any other metallurgical purpose for which they may be required. The amount of hydrogen they contain gives them great combustibility. They burn rapidly; and although they do not make a very hot fire, I think it will be found sufficiently intense for metallurgical purposes. There has been an impression that they could not be used, and coke has been sent for at a cost of $160 per ton, when these lignites could have been had for but a small portion of that amount.

The beds of asphalt and of petroleum deserve a moment's notice, inasmuch as they are very conspicuous in some localities, and have led to the expenditure of large amounts of money. In Southern California there is a great abundance of asphalt. Sometimes the ocean will be covered for miles with it. It is capable of being applied to a good purpose there, although it is not worth transporting to the Atlantic coast. There are similar deposits in Colorado, where they are called by the hunters "tar springs." There is no doubt in my mind that it is the residuum from the evaporation and distillation of petroleum.

The great question with regard to the value of the lignites is, whether they are applicable for smelting purposes. We know they are adapted for the generation of steam, for they are almost exclusively used for that purpose by the Pacific Railroad. I hope that what I have said will inspire sufficient confidence in their value to cause their trial for smelting purposes. It will be necessary to adapt the furnaces to them; but when rightly burned I have great confidence that they will be found fully equal to every demand which may be made of them.

The Mineral Resources of North Carolina.

BY F. A. GENTH.

[Continued from page 280.]

Arsenic, Antimony and Bismuth.—Only a few ores of arsenic and antimony have been noticed in North Carolina. Amongst these is very rare native antimony, of which a small piece was submitted to my examination by Dr. HUNTER, of Cottage Home, Lincoln County. It has been found in a small vein in Burke County. An examination proved it to be quite pure.

Both arsenic and antimony are found in combination with other metals; arsenic at a few localities in Union and Gaston Counties, in small quantities, as arsenopyrite or mispickel, associated with gold ores; and both arsenic and antimony in the highly argentiferous tetrahedrite of the McMakin, and the tetrahedrite of the Ludowick mines in Cabarrus County.

Bismuth has been observed as bismuthinite in minute particles associated with the gold and copper ores of the Barnhardt vein at Gold Hill, and by Dr. ASBURY as bismuthite with gold ores at the Asbury mine in Gaston County; also as bismite, or teroxide of bismuth, in the same mine, and in combination

* From the Journal of the Franklin Institute.

with copper, lead and sulphur at Colonel WHITE'S mine in Cabarrus County, probably as aikinite. The most interesting ores are the telluride of bismuth (tetradymite) and the tellurate of bismuth (montanite)—both found associated with gold ores in numerous localities—in Davidson, Cabarrus, Gaston, McDowell and Burke Counties. The bismuthic gold mentioned by SHEPARD as coming from Rutherford, is probably an artificial product resulting from the simultaneous amalgamation of gold and tetradymite.

Cobalt and Nickel.—Small quantities of these two metals have been observed in the manganese gossans of several mines in Gaston County, but thus far no regular workable deposit has been found.

Manganese.—No regular manganese deposits are as yet known in North Carolina ; small quantities of pyrolusite, psilomelane and wad have been observed associated with iron, gold and silver ores, in several localities in the State. Many of the iron ores contain a small percentage of manganese.

The *manganese garnet* may become of considerable importance in the iron industry ; it occurs in several large veins or beds. At Buckhorn it is associated with the magnetic iron, and serves as a valuable flux, it is also found near Danbury in Stokes County, in Rowan and Rutherford Counties.

Chrome.—Minute quantities are found in the magnetic iron belt passing through Guilford and Rockingham Counties. Deposits of considerable magnitude exist in the chrysolite beds of Jackson, Mitchell, Yancey and Watauga Counties.

None of them are worked at present.

Iron.—Although the mineral wealth of North Carolina is affirmed beyond a doubt by its numerous mines and deposits of gold, copper, silver and other metals, still its greatest resources consist in its vast iron ore beds, distributed throughout the entire State ; and when these are properly developed, their importance will by far exceed any other mining interest.

It may be safely predicted that, at an early day, North Carolina will stand foremost as an *iron*-producing State ; not only because the various varieties of iron ore exist in inexhaustible quantities, but also because they are of very superior quality, and offer all those requisites to making the better and more desirable grades of *iron* and *steel*.

The principal ores are : the pure magnetic iron, the titaniferous and chromiferous magnetic iron, menaccanite or titaniferous iron, hematite or specular iron, limonite or brown hematite, and carbonate of iron. These ores, especially the magnetites or hematites, being in reality only a more ferriferous portion of the stratification form strings of large lenticular beds in the rocks, here and there interrupted but extending for many miles, and in some instances stretching across the entire State.

The outcrops of those ore beds being so very numerous, I cannot do more than indicate the various ranges and localities where the ores are best developed.

But as there are also many places from which I have seen very fine ores, which require fuller investigation as to quantities, I will mention the locality, in the hope that this may lead to important discoveries. For the sake of convenience, I will commence with the most eastern locality, and take up the different nearly parallel beds in succession, up to the Tennessee line.

One mile east of Gaston, near the Roanoke river, three occurs a granular variety of hematite, more or less mixed with red and yellow ochre. The ore is apparently of very fine quality, but nothing is known as to whether it exists in quantities or not ; if found in abundance, its location would make it valuable.

A large deposit of brown hematite occurs in the slate formation connected with quartzites, four miles west of Smithfield, Johnson county, and a bluff of limonite is exposed at Whitacker's, seven or eight miles south-west of Raleigh, in argillaceous and chloritic slates.

The various iron ore deposits of Chatham and Moore Counties are of much greater importance.

At Buckhorn, on the Cape Fear river, a large bed of granular magnetite has been developed, from which, if I am correctly informed, about 6000 tons of very superior iron have been produced. The bed is between 20 and 30 feet thick, and lies almost horizontally between micaschist. This magnetite is associated and largely intermixed with manganesian garnet, which serves as a flux, and renders it very easy to smelt. The iron was used during the war for car-wheels, and was of such excellent quality that one of the wheels, coming accidentally into the possession of a firm in Wilmington, Delaware, induced them to purchase the property, with a view to establish similar works in North Carolina. The beds dip slightly to the south-east, and appear to extend in this direction, and also to the south side of Cape Fear river.

A number of beds of hematite or specular iron make their appearance in Chatham county, in the argillaceo-talcose slates ; the ores are the compact and granular hematite, of reddish, greyish and iron black color, sometimes laminated, foliated and micaceous.

In Moore county, 12 miles east of Carthage, near Governor's Creek, there occurs a pure massive kidney-shaped hematite, without admixture, probably the south-west continuation of one of the Chatham ore beds.

On Ore Hill, in Chatham county, not only red hematites are found, but also large beds of brown hematite or limonite. This hill is between 200 and 300 feet high, and perhaps two or more large veins of about 10 to 15 feet in thickness, intersect the hill in an east and west direction.

The limonites are of fine quality, but their appearance and geological position would indicate that they are merely "gossans," or decomposed pyritous ores, and the probability is that at a greater depth the unaltered sulphides will be found. Since my return from North Carolina, the Ore Hill has been sold for $150,000, and there is a prospect that the old furnace on the place will soon be rebuilt and be put into blast.

The Evans ore bed is from six to eight feet wide, and has been traced for nearly one mile ; it is about four or five miles from the Gulf, and consists of red hematite, of fine quality. Kelley's ore bed and several others show the same character.

The ores which I have seen are excellent, but none of them are worked.

Beds of granular magnetic iron, of fine quality, have also been found not far distant, but none of them are developed. One, for instance, is about 2 to 3 miles north of the Evans ore bed.

I cannot leave Chatham county without mentioning the peculiar ores which, many years ago, have been much speculated upon as being of immense value, I mean the so-called *Black Band* ores interstratified with the coal. There are three seams of this black band between the coal beds. One of these seams is six feet in thickness, and consists of argillaceous carbonate of iron in balls and layers.

Unfortunately, only a very small quantity of this ball ore could be selected which would be pure enough for the manufacture of iron. The *great mass* contains such an abundance of bones and teeth of saurians and fishes, that the amount of phosphoric acid in the same renders it absolutely worthless as an iron ore ; the quantity of phosphoric acid is so great, that it has been proposed to apply it to the soil as a manure.

A band of red hematite, probably the continuation of one of the Chatham county beds, passes through Orange county. It is quite prominent on a hill about 1½ mile north-west of Chapel Hill. The surface is covered with ore, some of it almost pure sesquioxide of iron. Like Pilot Knob, in Missouri, it forms a series of quartzose bands, frequently with bands of pure ore alternating with quartz more or less mixed with ore.

North-east from it, in the same county, at Red Mountain, extensive beds of this ore have been discovered.

In Montgomery, Randolph and Almance Counties, several iron ore beds have been found, which at a future day may become of importance.

Six or seven miles southwest of Troy, a band of hematite lies between bands of auriferous slates, bordered on one side by quartzite, on the other by slaty pyrophillite. It forms a mass of about 50′ wide, which has been traced a for quarter of a mile. The bed is traversed by massive hornblende.

About four miles north of Troy, a series of magnetic iron ore beds occur in the neighborhood of Carter's Gold Mines. The ore is frequently crystallized, friable, and is intermixed with talc and quartz. The continuation of some of these ore beds pass through Randolph and Alamance counties, where they yield ores of most excellent quality, as, for instance, three or four miles southwest of Franklinville, where an abundance of fine magnetite is found on the surface in the immediate proximity of a vein, and at La Grange ; at the latter place there also exist large deposits of bog iron ore.

Some of the most important developments have been made within the last two years by the North Carolina Centre Iron and Manufacturing Company, of this city, not only in the great titaniferous iron belt which passes principally through Guilford and Rockingham Counties, and extends through the edges of Forsythe and Davidson Counties, but also in numerous outcrops forming parallel ranges with this formation.

I have already mentioned the accumulation of iron ore in the gneissoid rocks of the Greensboro Belt.

The ore forms one or more strata between the rocks, and their extent has been proved for about 30 miles. Near the north-eastern extension the ore beds present a remarkable character, as proved by Prof. J. P. LESLEY. He has shown the beds to be outcrops of the same synclinal basin, the so-called Tuscarora range being the southeast outcrop, with a north-west dip, while the so-called Shaw range is the north-west outcrop, with a south-east dip. The ore is a granular magnetite, more or less mixed with a micaceous mineral, also with hematite or menaccanite, and in some places it is associated with granular corundum or emery.

The average yield of the ore is 55 per cent. of iron; it contains, as I have already mentioned, small quantities of chrome, cobalt and manganese, and on an average about 13 per cent. of titanic acid, equal to 8 per cent. of titanium.

This titanic acid is not chemically combined with all the ore ; in some of the varieties I have succeeded in separating, by the magnet, ore which was almost free from it, leaving the not magnetic menaccanite behind.

During the war, it was worked in bloomeries on a small scale, about two miles from Friendship, Guilford County, on a place which is now called Tuscarora, and has produced a quality of iron which was very remarkable for its toughness, its great strength and adaptation for the manufacture of steel.

Almost in range with these ore beds, magnetites as well as titaniferous iron ores have been found at several places in Mecklenburg County : the first, eight or nine miles from Charlotte, at Steel Creek Church ; also, about seven miles from the same town on the York road ; and the titaniferous ore near the old Harris mine, 12 miles south-east of Charlotte. It cannot at present be ascertained whether these ores are connected with those of Guilford County.

TO BE CONTINUED.

Atoms and Molecules.

BY SAMUEL D. TILLMAN, LL.D.

THE atomic composition of ponderable matter is a fundamental postulate in the theory of chemical equivalency. By the application of the principles of experimental research, and by methods essentiall

modern, resulting in the discovery of many elementary bodies and their modes of combination, a conception of very great antiquity has been rendered more distinct and worthy of credence. When this conception took definite form is not known. Indeed, it is one of the many speculations naturally elicited in discussing those subtle questions pertaining to the existence of matter and its relations to mind or spirit, the solution of which has always baffled, and will continue to baffle, the most profound thinkers. In attempting to unfold the mysteries of nature, by the deductive process, the ancient teachers of Cosmogony were brought into direct conflict of opinion regarding the ultimate condition of matter. That it is composed of indestructible atoms which admit of no division, seems to have been the notion of some Oriental sages. Under the genius of the Greek philosophy this notion assumed the form and consistency of a theory.

Among those who held the doctrine, while immatured, were ECPHANTUS, LEUCIPPUS and DEMOCRITUS. Subsequently EPICURUS introduced such modifications and improvements as were essential to its complete development.* The Latin poet, LUCRETIUS, in his "*De Rerum Natura*," has given a full exposition of the Epicurean philosophy: from this as well as from the writings of PLUTARCH, it will be seen that the most prominent atomic tenets did not differ essentially from the opinions entertained by eminent scientists of modern times.† NEWTON admitted the creation of primitive particles, extremely minute, but permanent. DESCARTES, on the other hand, held with ARISTOTLE, PLATO and PYTHAGORAS, that the division of matter has no assignable limit. LEIBNITZ attempted to reconcile the conflicting opinions of metaphysicians and mathematicians, by supposing that matter, in its ultimate condition, consists of unextended points which he denominated monads, a term borrowed from PYTHAGORAS. At a later day BOSCOVICH published his celebrated dynamic theory, in which centres of force are substituted for monads. Neither of these ingenious theories, however, reaches the real points of perplexity.

It is obvious that the science which treats of the ultimate composition of bodies would lead to more correct conceptions regarding minute combinations of ponderable matter. Analysis has shown that nearly all the bodies formed in the great laboratory of nature are compounds. Thus far sixty-three different kinds of matter have resisted every effort to resolve them into simple constituents. These substances, distinguished as chemical elements, unite in exceedingly minute quantities according to the well-known laws of Stoichiometry. In the year 1789, HIGGINS, a Professor in the University of Dublin, advanced the idea that certain compounds are formed by the combination of ultimate particles or atoms of different elements. DALTON, in 1803, independently arrived at a similar conclusion, which he generalized, to explain the composition of all compounds, and made it the basis of his "New System of Chemical Philosophy," published five years later. The doctrine of DALTON has undergone, since his day, such modifications as render it more acceptable; but that part of it which ascribes the union of indestructible atoms to chemical affinity may be regarded as the first successful attempt to explain that primordial action which the ancient atomists could not account for, and which the Latin poet above named, describes as irregular and fortuitous.*

Chemists of the atomic school happily avoid the vexed question concerning the indivisibility of matter, by defining an atom as the smallest quantity of an element which can enter into the composition of a ponderable molecule; and the molecule, whether made up of one, two or more elements, as the smallest quantity which can exist in a free state. However, a certain individuality must be assigned to the single atom, for a chemical decomposition requiring its transfer from one molecule to another, involves its isolation, *in transitu*. The absolute weight of the sixty-three different atoms cannot be ascertained; nevertheless their relative weights have been determined with great care.

It is difficult to arrive at any clear notions concerning the size of an object so minute as to be forever invisible under the most powerful magnifier. As an example of the conclusions regarding molecules, founded on microscopic scrutiny, that of the celebrated EHRENBURG may be cited.† Without attempting to make a close approximation towards its actual dimensions, his researches led him to infer that the diameter of an atom (the molecule of the chemist) was considerably less than six millionths of a line. Quite recently THOMPSON, in a paper "On the Size of Atoms,"‡ presented four lines of argument founded on experiments of physicists which all lead to substantially the same estimate of the dimensions of molecular structure. He says, "Jointly they establish, with what we cannot but regard as a very high degree of probability, the conclusion that, in any ordinary liquid, transparent solid, or seemingly opaque solid, the mean distance between the centres of contiguous molecules is less than the hundred-millionth and greater than the two thousand millionth of a centimeter. To form some conception of the degree of coarse-grainedness indicated by this conclusion, imagine a rain drop or a globe of glass as large as a pea to be magnified up to the size of the earth, each constituent molecule being magnified in the same proportion. The magnified structure would be coarser-grained than a heap of small shot, but probably less coarse-grained than a heap of cricket-balls."

From these deductions of THOMSON some idea may be formed of minute molecule grouping; and I venture the suggestion, that, in regard to size, the smallest bullet would, probably, stand about midway between the *glomeramen minimum* and "the great globe itself."

Beyond this point of extreme tenuity, where matter first exhibits that property which is revealed in visible forms, we are forced to consider it in a still more expanded state as the universally diffused medium of light, heat and actinism, consequently this conception of the minute ponderable globule does not bring us very near the *minima naturæ*, for a difference in size cannot be less marked between ponderable atoms and those infinitesimal particles forming the luminiferous ether or æth, which fills the interstellar spaces, and which, in a more condensed state, probably forms the inter-atomic medium. Assuming that all forces generating wave motions in elastic fluids follow the same law of propagation, I endeavored some years ago, to estimate the density of this inconceivably attenuated substance.*

In that calculation the density of air is the unit of measure. If instead, hydrogen be taken as the unit, the density of the luminiferous ether is expressed by the decimal ·00000000001653. Whatever may be its actual density, its reality must be admitted, until the positions established by the investigations of Huyghens, Young, Fresnel, Foucault, and Fizeau, are shown to be untenable. A very able American metaphysician, in meeting an objection brought by Huxley against the views of Comte, has strongly expressed his unqualified dissent;† nevertheless the hypothesis that light, heat and actinism are propogated by the undulations of a subtle, all-pervading fluid, is the only one which satisfactorily accounts for a certain class of phenomena, and it is accepted by all the prominent experimental physicists of the present day.

The vast difference in density indicated cannot be apprehended because numerical comparisons utterly fail to raise in the mind any clear conception regarding a fluid so attenuated; yet it naturally suggests the idea that there must be many intervening conditions of matter in which it exists in successive degrees of increasing density, and that these conditions form the connecting links so to speak, between its apparently imponderable and ponderable states. Something like this opinion seems to have been maintained in a curious work published in England many years ago.‡ The reverend author, viewing the universe as a systematic manifestation of the Divine Will, assumes that the medium of light is the mother element from which by progressive steps the chemical elements have been evolved. Proceeding from the first lines of morphology, he arrives at the primitive form which cannot be isolated; then by an exceedingly ingenious synthetic process he represents by diagrams his ideal structure of the different kinds of atoms, all of which are duplications of the tetrahedron. Thus he claims to reveal the unit, by multiples of which the atomic weight of all chemical elements may be expressed, and so arrives at a result which will be recognized as simply a modification of the so-called law of Prout. Although this, and other remarkable surmises by Macvicar are, for reasons which may not here be adduced, quite untenable, he seems to have led the way to an assumption which has recently met with some favor, that the chemical atom, although indivisible, is a collection of smaller particles. However, in following this author towards the infinitesimal, we only realize more fully the truth, that above and below the narrow zone of the visible are objects too far off and too fine for human scrutiny. Although the SEEMING ALL is rounded by intimations of other and brighter regions, Science can never compass them by any extension of her domain! In those unsounded depths which form the boundary and background of the known, thought, grown dizzy, finds no support; and even the positivist turns back bewildered, when mensuration fails and computations end in surds!

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* Plutarch's Morals. Edited by Prof. GOODWIN of Harvard University. Little, Brown & Co., Boston, Mass. Vol. VIII, pp. 111-112. Vol. V., p. 345.

† A full exposition of the ancient atomic philosophy would be foreign to the purpose of this paper. Many of the prevailing erroneous impressions concerning it would, however, be corrected by an examination of the Third Chapter of Dr. Good's Book of Nature, in which Epicurus is ably defended against the charge of atheism. Evidently the Epicureans were opposed to Mythology; but while ignoring the power of its gods they were naturally led to the recognition of a higher Power, an Intelligent Cause, Self existent and Supreme. This deduction was reached by the earliest believers in the atomic doctrine. According to Stobæus, Ecphantus supposed the material world to consist of atoms, but yet to be ordered and governed by a Divine Providence. And as evidence of the belief prevalent among wise men several centuries later, BERZELIUS, in his paper on "Proportions, determinate," quotes from Philo, who in his collection of the choicest philosophical ideas of his time (Libri Sapientiæ, Cap. XI. v. 22), says: "God made all things by measure, number and weight." This remarkable statement, as far as it relates to things terrestrial, modern chemical investigations have fully confirmed.

* Omnimodis coire, atque omnia pertentare,
Quæcunque inter se possint congressa creare.
Lucret. lib. V. ver. 191.

† *Pogg. Annalen*, 24, 35.

‡ *Nature*, No. 22, p. 551.

* Sound would be propagated, with exactly the velocity of light through a fluid, under the standard pressure, 874,094,104,900 times rarer than air. Therefore, if the density of air be 1. the density of æth is represented by the decimal .000,000,000,001,144+.

It will not be inferred from this view that the aim has been to reach

"The first of things, quintessence pure,"

for the elastic quality of æth involves the hypothesis of a still more subtle fluid. We have raised one curtain only to find another to be raised. As the unfathomed vaults of Heaven recede before the sweep of a more powerful refractor, and nebulæ resolved reveal nebulæ beyond, so the most diminutive germ that springs from the Creator's touch, discloses through the lens of higher power, new signs of more wonderful mechanism within. Each nucleus has its nuclei! Each entoblast is but the boundary of a microcosm! Each particle, a galaxy of atoms revolving in the all-pervading æth! Thus before every far-reaching human advance, *Circumference* and *Center* will for ever retreat.—*Transactions of the American Institute*. 1864. p. 539. (Clydonics. No. 1.)

† Eleventh Harvard lecture. By Prof. JOHN FISKE. Cambridge, Mass., 1869.

‡ Elements of the Economy of Nature. By. J. G. MACVICAR, D.D. London: Chapman & Hall. 1856.

TO BE CONTINUED.

THE COAL TRADE.

NEW YORK, May 3, 1872.

Anthracite Coals.

The dullness of the market has, if anything, increased since our last, and prices have a downward tendency, occasioning heavy sacrifices to everybody engaged in the trade. The principal reason generally assigned for this state of affairs is too great a production and a consequent overcrowding of the market.

Bituminous Coals.

For this class of coal the demand keeps up fully with the supply and prices are unchanged. It is believed that the transactions in bituminous coals might be materially increased if larger quantities could come to market, but this is not possible at present on account of the great scarcity of vessels.

Anthracite Coal Trade for 1871 and 1872.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending April 27, 1872, compared with the week ending April 29, 1871.

COMPANIES.	1871. WEEK.	1871. TOTAL.	1872. WEEK.	1872. TOTAL.
*Phila & Reading R.R†	53,018	902,823	126,480	1,533,331
Schuylkill Canal	9,948	66,204	30,472	129,631
Lehigh Valley R. R.	13,317	444,807	68,130	1,154 916
Lehigh & Sus. R. R.	15.146	133,834	41,343	477,801
Lehigh Canal	1,691	3,634	20,927	50,795
Scranton North	....	3,521	....	181,847
" South	....	* 137	....	624,223
Penn. Coal Co., rail	....	3,566	29,201	342,290
" " canal	....	.....	356	356
Del. & Hud. Canal Co.	....	4,661	32,648	49,206
" East	393	52,537	11,693	202,432
" " West	....	12,720	.....	104,283
" " South	....	.....	7,307	112,139
Shamokin	23,809	189,173	8,547	135,473
Trevorton	....	.....	....	....
Lykens Valley Coal Co.	2,245	20,961	..	2,580
Wyoming South	....	.....	....	....
Wyoming North	....	.....	....	....
P. N. Y. C. & R. R. Co.	5	35,348	12,173	210,872
Williamstown Col'y	....	17.847	....	....
Big Lick Col	3,635	32,758	....	10,591
Total	123,207	1,924,530	389,277	5,322,766
1870	....	....	123,207	1,924'530
Decrease				
Increase			266,070	3,398,236

* These figures are for the week and fiscal period commencing Nov. 30.

† Less coal transported for Co's use and Bituminous coal.

Bituminous Coal Trade, 1871 and 1872.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending April 27, 1872, compared with week ending April 29, 1871.

COMPANIES.	1871. Week.	1871. Year.	1872. Week.	1872. Year.
C. & O. Canal	20,869	128,117	16 527	99,295
B. & O. R. R.	30,906	344,042	30,531	356,485
H. & B. T. R. R.	10,575	111,621	....	87,940
*Harrisburg & D	20,731	183,052	7,908	191,900
*L. V. R. R.	....	23,325	298	11,493
P. & N.Y.C. & R. Co.	6,063	93,284	8,440	127,657
Cumberl'd Branch Canal	6,202	39,454	5,994	32,843
" Railroad	1,810	24,250	932	2,973
Total	97,156	947.150	70,630	910,586
	* 70,630	910.586		
Decrease	26,526	36,564		
Increase				

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending April 27—Compared with same time last year.

WHERE SHIPPED FROM	WEEK 1872., tons ct	WEEK 1871. tons ct.	YEAR 1872 tons cwt.	YEAR 1871, ons.cwt.
Wyoming Region	36545 15	17566 01	362834 19	129769 02
Upper Lehigh Region	3231 15		62399 12	4614 06
Beaver Meadow Region				
Hazleton Region	7641 13	128 12	20874 00	1255 10
Mahanoy Region				
Tresckow Region	3969 00		27899 13	1043 03
Mauch Chunk Region	8010 10	404 12	12997 12	26758 16
Totals	59398 13	18099 05	508905 16	157440 17
Increase	41299 08		440564 19	
Decrease				
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	41342 16	15145 19	477801 10	133834 05
Forwarded East of Mch Chunk by Canal	11721 12	1393 06	30278 10	2762 06
Delivered at and above Mauch Chunk	976 16	1507 07	20727 15	18167 05
L. V. R. R at Packer'n	232 05	52 13	5099 07	2677 01
Delivered to L. & B. R. R.at Plymouth Bridge	5125 04		64098 14	
Totals				
Of the above there was transported on acc'nt of L. C. & N. Co.	12951 12	404 12	142330 19	21995 03
W.-B. C. & I. Co.	25623 19	16226 19	265755 05	106554 08
Totals	38575 11	16631 11	408086 01	128549 11
Increase	21944 00		279536 13	
Decrease				

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending April 27, 1872.

	1872. WEEK.	1872. YEAR.	1871. WEEK.	1871. YEAR.
By Railway	29,200 11	342,289 13		3,566 08
" Canal	355 11	355 11		
Total	29 556 02	342,645 04		3,566 08
Increase 1872	339,078 16			

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, April 27, 1872.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	6,546	16
" Port Carbon	6,136	06
" Pottsville	2,575	14
" Schuylkill Haven	40,054	13
" Pine Grove	6,137	05
" Tamaqua	18,087	08
" Harrisburg	38	05
" Dauphin	4,998	08
Total	84,574	15

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	2,935	05
" Mill Creek "	3,216	17
" Schuylkill Valley Scales	2,737	13
" Mt. Carbon "	791	04
" Cressona "	18,373	05
" Pine Grove "		
" Tamaqua "	2,595	08
Total	30,649	12

SHIPPED WESTWARD VIA NORTHERN CENTRAL RAILROAD.

Passing Locust Gap	1,804	00
" Shamokin	3,648	04
" Herndon	.....	
Total	5,452	04

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	1,256	03
" Lebanon & Pine Grove Branch	914	00
Total	2,170	03

CONSUMED ON LATERALS.

From Frackville Scales	121	00
" Mill Creek "	319	06
" Schuylkill Valley Scales	310	08
" Mt. Carbon "	490	15
" Cressona "	200	00
" Pine Grove "	173	09
" Tamaqua "	830	10
Total	2,445	08

LEHIGH AND WYOMING COAL.

Received via Allentown, E. Penn'a Br.	48	13
" " Alburtis, "	.....	
" " Oreland, G. & N. Br.	624	09
" " Connecting R. R.	.....	
" " Willow Street R. R.	515	06
Tota	1,188	08

BITUMINOUS.

From Harrisburg	7,898	03
" Connecting R. R., G. & N. Br.	.....	
" Junction R. R.	10	00
Total	7,908	03

COAL FOR COMPANY'S USE.

Anthracite	7,172	12
Bituminous	444	09
Total.	7,617	01

RECAPITULATION

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	84,574 15	22,911 12	i 61,663 03
For Shipment by Canal	30,649 12	10,932 17	i 19,716 15
Shipped Westward via Northern Central R. R.	5,452 04	15,245 06	d 9,793 02
Shipped West or South from Pine Grove	2,170 03	1,180 19	i 989 04
Consumed on Laterals	2,445 08	2,671 16	d 226 08
Lehigh and Wyoming Coal	1,188 08	75 01	i 1,113 07
Total Anthracite paying freig't	126,480 10	53,017 11	i 73,462 19
Bituminous	7,908 03	20,730 17	d 12,822 14
Total of all kinds paying freig't	134,388 13	73,748 08	i 60,640 05
Coal for Company's use	7,617 01	7,009 01	d 608 00
Total Tonnage for Week	142,005 14	80,757 09	i 61.248 05
Previously this year	1684315 03	1092430 06	i 591,884 17
Total to date	1826320 17	1173187 15	i 653,133 02

SHIPPED BY CANAL.

From Schuylkill Haven	27,964 00	5,415 00	i 22,549 00
" Port Clinton	2,508 00	3,884 00	d 1,376 00
Total Tonnage per Week	30,472 00	9,299 00	i 21,173 06
Previously this year	99,159 09	60,648 12	i 38,510 17
Total to date	129,631 09	69,947 12	i 59.683 17

Schuylkill Canal.

Report of coal transported over the Schuylkill Canal for the week ending Saturday, April 27, 1872.

	Tons.	Cwt.
From Schuylkill Haven	27,964	00
" Port Clinton	2,508	00
Total for week	30,472	00
Previously this year	99,159	09
Total	129,631	09
To same time last year	66,263	12

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, April 27, 1872.

	WEEK.	SEASON.
North	50,657 17	778,011 12
South	7,306 13	112,138 17
Total 1872	57,964 10	890,150 03
Corresponding time in 1871 :		
North	Suspension.	
South	"	
Total		
Increase North		
Decrease North		
Increase South		
Decrease South		
Total decrease 1872		
Total increase 1872	57,964 10	890,150 03

Delaware and Hudson Canal Company.

The following is a statement of Coal Transported by the Delaware and Hudson Canal Co. for the week ending April 27, 1872.

	FOR THE WEEK.	FOR THE SEASON.
By Delaware and Hudson Canal,	32,648	49,206
By Railroad, East	11,693	202,432
" " West		104,283
" " South	7,307	112,139
Total Tons	51,648	468,060

For the same period last year.

	FOR THE WEEK	FOR THE SEASON.
By Delaware and Hudson Canal,		4,660
By Railroad, East,	393	52,537
" " West		12,720
" " South		
Total Tons	393	69,917
Increase	398,143	

Lehigh Canal Coal Trade.

Shipped for the week ending April 26th, 1872.

	Week. Tons.	Cwt.	Week. Tons.	Cwt
Total from Mauch Chunk Region	7,864	08	20,645	19
" " Beaver Meadow "	3,277	19	8,910	16
" " Tresckow "	383	02	1,728	02
" " Mahanoy "	388	06	871	19
" " Hazleton "	7,478	14	15,885	16
" " Upper Lehigh "	809	02	1,755	16
" " Wyoming "	725	07	996	12
Total	20,926	18	50,795	00
Corresponding week last year	1,691	07	3,634	02
Increase	19,235	11	47,160	18
Decrease				

Shamokin Coal Trade.

For week ending April 27, 1872	8,547 08
Same time last year	23,808 18
Increase	
Decrease	15,261 09
Total amount shipped to date	135,473 06
Same time last year	189,173 06
Increase	
Decrease	53,700 00

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday April 27, and during the year 1872, compared with the corresponding period of 1871.

WEEK.

	To C.& O. Canal Tons.	Cwt.	To B.&O. R.R. C. Tons.	Cwt	Total. Tons	Cwt.
1872	16,527	01	30,530	15	47,057	16
1871	20,869	09	30,905	16	51,775	05
Increase						
Decrease	4,342	08	375	01	4,717	09

YEAR.

1872	99,294	11	356,485	05	455,779	16
1871	128,117	01	344,041	14	472,158	15
Increase	....		12,443	11		
Decrease	28,822	10			16,378	19

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons.	Cwt.	To B.&O.R.R. Co Tons	Cwt.	Total. Tons.	Cwt.
1872	5,994	01	932	07	6,926	08
1871	6,201	14	1,809	14	8,011	08
Increase						
Decrease	207	13	877	07	1,085	06

YEAR.

1872	32,842	15	2,972	19	35,815	14
1871	39,459	05	24,250	03	63,709	08
Increase						
Decrease	6,616	10	21,277	04	27,893	14

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending April 27, 1872, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	10.575 14	196,475 14
" Hazleton	49,579 07	771,073 08
" Upper Lehigh	55 10	1,191 17
" Beaver Meadow	19,293 15	290,122 06
" Mahanoy	10,289 04	108,643 17
" Mauch Chunk	28 04	1,401 09
Total	89,681 14	1,368,907 11
Same time last year	14,290 09	803,272 03
Increase	75,391 05	855,635 08
Decrease		
Forwarded East from Mauch Chunk by rail	68,130 00	1,154,916 00
Same time last year	13,317 00	444,807 00
Increase	54,814 00	710,109 00
Decrease		

DISTRIBUTED AS FOLLOWS.

Forwarded East from Mauch Chunk by rail	67,306 07	1,133,771 10
do East for use L. V. R. R.	823 17	21,144 02
Delivered at and above Mauch Chunk for use of L. V. R.R.	1,090 09	24,073 00
To P. & N. Y. R. R.	6,889 01	119,930 13
To N. C. R. R., at Mount Carmel	604 07	677 13
To D. H & W. R. R.	1,058 02	10,602 05
To L. & S. R. R. at Packerton for rail	194 18	6,016 12
Delivered at M'h Chunk	44 10	886 12
Delivered on line of road above Mauch Chunk	440 00	9,035,16
To L. & S. R. R., at Penn Hav., for railroad		3,960 07
Do. for canal	7,378 18	16,451 17
To Lehigh Canal Mauch Chunk	3,666 05	9,804 09
To Catawisa Railroad	191 00	2,563 00
Total	89,681 14	1,368,907 11

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending April 27, 1872.

	Week. Tons.	Cwt.	Total. Tons.	Cwt.
Anthracite received :				
From Lehigh Valley R. R.	6,889	01	119,930	13
" Lack. & B. R.R.	2,052	08	30,390	16
" Pleasant Valley R. R.	2,016	02	38,633	17
" Sul. & Erie R. R.	1,215	12	21,917	03
Total	12,173	03	210,872	09
Distributed :				
To Lehigh Valley R. R.	1,094	19	20,878	10
To Lack. & B. R. R.			1,017	17
To S. Central R. R.	4,717	19	40,725	06
To Ithaca & A. R. R.	1,365	10	45,950	06
To Erie R. W. Pockets for shipm't.	4,285	03	63,549	14
To individuals on line of road	200	11	11,640	18
To points at & above Coxton for use of Co.	509	01	10,233	08
To points between Waverley and Elmira			16,876	10
Total	12,173	03	210,872	09
Bituminous :				
Received from Barclay R. R.				
Shipped North from Towanda	8,440	02	126,645	05
Shipped South from Towanda			920	12
Northern Central R. R.			91	01
Total	8,440	02	127,656	18
Distributed :				
To Erie R. R.	7,830	09	112,267	04
To So. Central R. R.	609	13	14,226	06
To Ithaca & A. R. R.	.....		21	15
To Lehigh Valley R. R.	.....		790	02
To individuals on line of R R.	.....		263	11
To points on line of road for use of Company			88	00
Total	8,440	02	127,656	18

Lehigh Coal and Navigation Company,

Report of Coal transported over the Lehigh Canal and L. & S., Div. of Central Railroad of New Jersey for the week ending April 27, 1872, and for the year 1872.

	WEEK.	YEAR.
Forwarded East of Mauch Chunk by Rail	41,342	477,801
Delivered at and above do.,	976	20,727
Forwarded East of do., by Canal	20,926	50,795
	63,246	549,321
Corresponding period last year—		
Forwarded East of Mauch Chunk by Rail	15,145	133,834
Delivered at and above do.,	1,507	18,167
Forwarded East of do., by Canal	1,691	3,634
	18,344	155,635
Increase on Railroad	25 666	346,527
Decrease " "		
Increase on Canal	19,235	47,160
Decrease " "		
Of the above there was transported on account of—		
Lehigh Coal Nav. Co.	20,816	162,976
Wilkesbarre Coal & Iron Co	25,623	265,755
	46,439	428,732
Corresponding period last year—		
Lehigh Coal Nav. Co	404	22,183
Wilkesbarre Coal & Iron Co.	16,226	106,554
	16 631	128,737
Increase	29,808	299,994
Decrease		

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

	AT NEW YORK. May 3. R. A.	W. A.	AT PHILADELPHIA. May 3. R. A.	W. A.
SCHUYLKILL.				
Lump	$- —	$- —	- —	
Steamer,	- —	- —	- —	- —
Broken,	- —	- —	- —	
Egg	5 25	4 75	- —	- —
Stove	5 50	5 00	- —	- —
Chestnut,	4 25	—	- —	
Pea	- —	- —	- —	- —
LEHIGH.				
Lump, (along side)	5 00	——	- —	- —
Broken	4 75	- —	- —	- —
Egg	4 50	- —	- —	- —
Stove	5 25	- —	- —	- —
Chestnut	4 25	- —	- —	- —
Pea	- —	- —	- —	- —
SPECIAL COALS.*				
Honey Brook, Le'h	W.A. 4 00@4 75		- —	- —
Spring Mountain	" " - —@- —		- —	- —
Sugar Creek	" " - —@- —		- —	- —
Sugar Loaf	" " - —@- —		- —	- —
Old Compy's	" " 4 00@4 75		- —	- —
Room Run	" 4 00@4 75		- —	- —
McNeal	" "	- —	- —	- —
Girardville	" "	—	- —	- —
Hill & Harris	" "	- —	3 10@4 00	-
Shamokin	" "	- —	- —	- —
Lykens Valley	" "	- —	- —	- —
Broad Top	" "	- —	- —	- —
McMichael	" "	- —	3 25@4 25	- —
Henry Clay	" "	- —	- —	- —
Powelton	"	- —	- —	- —

Dealers in these coals may be found in our advertising columns.

Company Coals.

May, 1872.

	L.	Str.	Gra	Eg.	Sto	Chest
*Scranton at E. Port	3 47	3 53	3 60	3 63	4 09	3 58
*Pittston at Newburg	3 90	3 90	4 00	4 10	4 25	4 00
*Lackawana at Weehawken	3 75	3 75	3 85	3 85	4 25	3 75
Wilk'b're at Hoboken	3 75	3 75	3 85	3 85	4 25	3 80
Old Co. Lehigh at Pt.John'n	5 25	—	4 40	4 40	4 60	4 10
Lehigh at Eliz. Port	5 00	—	4 25	4 25	4 50	4 00

For freights to different points see "Freights."
* To contractors only.

Bituminous Coals (Cumberland).

Georgetown, F.o.b.	$4.25
Baltimore "	4.70
New York	6.75

Prices of Gas Coals.

May, 1872.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N. Y.
Duty, $1 25, gold

	Coarse.	Slack.
Block House	$1 60 @-1 75	
Gowrie	1 60 @-1 75	

Corrected by Bird, Perkins & Job, 86 South street.

	Coarse.	Culm of Coal.
Pictou	$2 25 @1 25	
Sydney	25 @- 80	
Lingan	1 60 @- 80	
Little Glace Bay	1 60 @1 00	
Caledonia	1 60 @- 80	

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty $1 25 per ton, gold, on the coarse coal. 25 per cent. ad valorem on the Culm of Coal

AMERICAN.

	Currency.
Westmoreland	$7 00 @- —
Fairmount Gas Coal Co. of N. Y.	7 00 @- —
Despard Coal Co.	7 00 @- —
Penn.	7 00 @- —
Newburg Orrel Gas	- — @- —
West Fairmount Gas Coal	7 00 @- —

AT PHILADELPHIA.

Powelton	$6 75

TO NEW YORK.

Provincial	
Sidney	$3 25
Lingan	3 25
Gow Bay	3 37½
Port Caledonia	3 37½
Little Glace Bay	3 25

Prices of Foreign Coals.

May, 1872.
Duty $1 25 per ton.
Corrected weekly by PARMELE BROS., No 32 Pine street, N. Y.

Liverpool Gas Caking	$ 8 00@— —
" " Cannel	12 00@13 00
" House "	18 00@20 00
" Orrel	14 00@16 00

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD,

Liverpool House Orrel, screened	$16 00@17 50
" Cannel, "	20 00@25 00

Per ton 2,000 lbs. delivered.

Freights.—May, 1872.

TO EASTERN PORTS.	Cumberland. From Georgetown.	From Baltimore.	Anthracite. From Philadelphia.	From Elizabeth Port, Port Johnson, and Hoboken.	From Newburg....	From Rondout...
Amesbury				2 95		
Bangor				2 50		
Bath						
Boston	3 25	3 75	3 75	2 60		2 90
Bridgeport	2 75	2 75		1 00		1 25
Bristol				1 70		1 85
Derby	3 58			1 25		
Dighton	3 00	2 75				
East Cambridge						1 85
Fall River	3 00	3 00		1 60		
Hackensack						
Hartford	3 50			1 50		1 75
Hoboken	2 10					
Jersey City	2 10	2 00		50		
Middletown						1 50
Mystic				1 35		
New Bedford	3 00	3 00		1 70		1 85
Newburyport		3 50		2 75		3 10
New Haven	2 75	2 75		1 00		
New London	3 00	2 75		1 30		1 25
Newport				1 70		1 80
New York	2 15	2 15		50		65
Norwalk				1 00		1 25
Norwich				1 40		1 60
Pawtucket				1 80		1 95
Portland		3 75		2 45		3 10
Portsmouth, N.H		3 90		2 80		
Providence	3 00	3 00		1 75		1 85
Rockport						
Saco						
Sag Harbor		3 75				
Salem		3 85		2 50		2 90
Stamford						
Stonington				1 20		1 65
Taunton						
Warren				1 70		
Washington						
TO RIVER PORTS.						
Albany					55	
Catskill					50	
Cocksackie					50	
Coeyman's					65	
Cold Spring					20	
Fishkill					20	
Haverstraw					40	
Hudson					40	
New York						
Nyack					45	
Poughkeepsie					30	
Rhinebeck					30	
Rondout						
Saugerties					40	
Sing Sing					50	
Stuyvesant						
Tarrytown					50	
Troy					75	
West Point					20	
Yonkers					50	

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven for consumption	$1 85
For reshipment	1 75

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 66
C. R. R., N. J., Phillipsburgh to Elizabethport	0 98
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$1 99

MAUCH CHUNK TO PORT JOHNSON.

L. V. R.R., or L. & S. R.R. from M. C. to Phillipsb'g	$0 66
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	0 98
Shipping expenses	25
Wharfage	10
Total	$1 99

TO HOBOKEN.

L. V. R. R., Mauch Chunk to Phillipsburgh	66
Morris & Essex R. R. Phillipsburgh to Hoboken	0 98
Shipping expenses	25
Wharfage	10
Total	$1 99

TO SOUTH AMBOY.

L. V. R. R.	66
B. & D. R. R.	83
Cam. & Am. R. R.	
Shipping Expenses,	35
Total	$1 84

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	0 78
C. RR. of N. J. Phillipsburgh to Elizabethport	0 98
Shipping expenses	25
Wharfage	10
Total	$ 1 12

MARKET REVIEW.

FOR THE WEEK ENDING MAY 1, 1872.

IRON—The market for Scotch Pig is somewhat unsettled—there is very little inquiry, and several large invoices are now about due, which has had a tendency to weaken the views of holders. We quote spot parcels $53 a$55, and to arrive $49a$51, as to brand, but we hear of no sales since our last. The market for American has also shaded a trifle, there being several outside lots pressing on the market, and holders are anxious to realize. We quote No. 1 $49a$51, and No. 2 $48a$50, with sales of 375 tons No. 1 North River, part at $50 at Hudson, and 200 tons Crane on private terms. Wrought Scrap is in light supply and steady at $63a$65, dock and yard; 100 tons from yard sold at $65; 100 do. from wharf, and 350 do. to arrive, on private terms. New Rails have met with very little inquiry since our last, but the stock is not large and the market is firm at our quotations. Refined Bar from store and Mill, is without change, the demand from store, being fair, and the orders at Mill, ahead of production, especially so in England.

PHILADELPHIA, April 29.—(From Circular of EDWARD SAMUEL.)—Although there is no disposition on the part of sellers of Pig to realize below quoted figures, the market can hardly be called so firm. The same remarks apply to Raw Irons of most all descriptions. The mail per "Cuba," April 12th, brings us advices of further advances in Raw and Manufactured Irons of all grades. Staffordshire Bars are quoted at £13 10s., against £8 5s. this time last year. Closing prices American No. 1 Foundry Pig at furnace $49a$50, No. 2 $48a$49, No. 3 Forge $46a$47, No. 4 White and Mottled $41a$43, American Refined Bar (mill price) $103,04 or 4.6 cents, Common Bar (mill price) $90a$95, and Rails (at mill) $85.

COPPER—New Sheathing is quoted as before, say 46 cents, and Bolts and Braziers 48, Bronze and Yellow Metal Sheathing 30, and Yellow Metal Bolts 32, net cash. The market for Ingot remains in the same apathetic condition. Lake will begin to come forward in about a month, and in the meantime consumers confine their purchases to just sufficient to carry them along from week to week. The business has been confined to a few small parcels, in all say 50a60,000 lb. Lake at 41a42 cents, cash, with no sales for future delivery, 35 cents asked. In English, some 150,000a160,000 lb. Best Selected sold mostly at 35 cents, though at the close this was an extreme price.

LEAD—Since our last, Foreign Pig has been quiet; prices however remain firm, and are still rather in sellers' favor, ordinary being generally held at 6½a6¾ cents gold. Bar 8½ cents, Pipe and Sheet 10, and Tin-lined Pipe 15 cash, less 10 per cent. to the Trade.

STEEL—The market is steady and firm at the advance in English noted in our last.

SPELTER—Remains quiet but firm at 7¼a7⅜ cents gold for Silesian. The Foreign markets harden, and the indications seem to point to higher prices in the future. Domestic is held at 10c. currency.

TIN—The market for Pig remains in the same dull state; prices have been reduced about two cents per lb., gold, from the highest point, but without stimulating the demand. The quotations now are very nearly the same as those that were current immediately previous to the Dutch sale, we call them nominally Straits and English 40a41 cents, and Banca 48a50 gold. We have only to notice sales of 5 tons English at 40 cents gold; and 500 slabs Straits, on private terms. Plates continue in good demand, sellers still having the advantage. The transactions embrace 1000 bxs. Charcoal Tin at $13,75 for I. C.; 500 do. Coke Tin, 14 by 20, $12,50; about 4000 do. Charcoal Terne, inlcuding all in outside hands, at$12 a

$12,25, now held at $12,50a$13 ; 100 do. S. T. P., $12,75, all gold ; and 1000 do. Charcoal Tin, on private terms.

ZINC—The market for Sheet is quiet at our quotations. Manganese black oxide 4½ ; Manganese Pyrolusite 5½.

METALS.

NEW YORK, May 1, 1872.

IRON.—Duty: Bars, 1 to 1¼ cents ℔ lb; Railroad, 70 cents ℔ 100 lbs.; Boiler and Plate, 1¼ cents ℔ lb ; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ℔ lb; Pig, $7 ℔ ton; Polished Sheet, 3 cts. ℔ lb ; Galvanized 2½; Scrap Cast, $6; Scrap Wrought, $8 per ton.

	Store Prices
Pig, Scotch No. 1, ℔ ton	49 00@55 00
Pig, American, No. 1	49 00@57 —
Pig, American, No. 2	48 00@50 —
Pig, American, Forge	46 00@48 —
Bar Refined, English and American	100 00@105 00
Bar Swedes, assorted size	85 00@100 00

	Store Prices, Cash.
Bar, Swedes	125 00@135 00
Bar, Refined, ¾ to 2 in. rd. & sq. 1 to 6 in. x ¾ to 1 in.	110 00@— —
Bar, Refined, 1⅛ to 6 by ¼ & 5:16 & 2½ to 2⅞ rnd. sq..	115 00@— —
Bar, Refined. 1 & 1¼ by ¼ & 5:16	117 50@— —
Large Rounds	122 50@127 50
Scroll	122 50@152 50
Ovals and half-round	127 50@137 50
Band	— —@122 50
Horse Shoe	120 00@130 50
Rods, ⅜ to 3-16 inch	115 00@155 00
Hoop	135 00@177 50
Nail rod	8 @— —
Sheet, Russia, as to assortment (gold)	— @ 18 ¼
Sheet, Singles, D. and T. Common	—6½@— 7¾
Sheet, D. and T. Charcoal	—7½@— 8½
Sheet, Galv'd, Nos. 10 to 27	—@— —
" " Nos. 28, and 29.	—@— —
Rails, English (gold), ℔ ton	75@77 00
Rails, American, at Works in Pa.	83@85 00

COPPER.—Duty: Pig, Bar, and Ingot, 5 ; old Copper 4 cents ℔ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ℔ lb	— @— 46
Copper Bolts	— @— 48
Copper Braziers, 16oz. and over	— @— 48
Copper Nails	— @— 51
Copper, Old Sheathing, &c. mixed lots	— @— —
Copper, Old, for chemical purposes, 14@16 oz.	— @— —
Copper English Pig	33 @— 35
Copper, American Ingot	41 @— 42
Yellow Metal, New Sheathing & Bronze	— @— 30
Yellow Metal Bolts	— @— 32
Yellow Metal Nails	30 @— 32

LEAD.—Duty: Pig, $2 ℔ 100 lbs.; old Lead, 1¼ cents ℔ lb; Pipe and Sheet, 2¼ cents ℔ lb.

	$— @—
Galena, ℔ 100 lbs	— —
Spanish (gold)	6 37½@6 50
German, do.	6 37½@6 50
English do.	6 37½@7 00
Bar (net)	8 50 @— —
Pipe (net)	— —@10 00
Sheet	— —@10 00

Colwell, Shaw & Willard Tin-Lined Lead Pipe 15 cts. ℔ lb.

STEEL.—Duty: Bars and ingots, valued at 7 cents ℔ lb or under, 2¼ cents; over 7 cents and not above 11, 3 cents ℔ lb ; over 11 cents, 3½ cents ℔ lb. and 10 ℔ cent ad val. Store prices.

English Cast (2d and 1st quality) ℔ lb	— 16½@— 18½
English Spring (2d and 1st quality)	— 7½@— 10½
English Blister (2d and 1st quality)	— 10½@— 12½
English Machinery	— 11½@— 13¾
English German (2d and 1st quality)	— 10½@— 12
American Blister "Black Diamond"	— —@— 12
American, Cast, Tool do.	— 15 @— 16
American, Spring, do.	— 9 @— 11
American Machinery do.	— 10 @— 10½
American German, do.	— 9 @— 11

TIN.—Duty: Pig, Bars, and Blocks, 15 ℔ cent. ad val.; Plate and Sheets and Terne Plates, 25 ℔ cent. ; Roofing 25. ad val.

	Gold ℔ lb.
Banca	48 @50
Straits	40 @41
English	40 @41

PLATES.

Fair to Good Brands.	Gold.	Currency.
I. C. Charcoal, ℔ box	$14 00 @14 50	$15 50 @16 00
I.C. Coke	12 50 @13 50	14 00 @15 00
Coke Terne	10 75 @11 25	12 00 @12 50
Charcoal Terne	12 50 @13 00	14 00 @14 75

SPELTER—Duty: In Pigs, Bars & Plates, $1.50 p. 100 lb

Plates, Foreign (gold) p. 100 lb.	7 25 @ 7 37½
Plates, Domestic p. lb.	— 7 @— 11

ZINC—Duty : Pig or Block, $1.50 per 100 lb. ; Sheet 2½c per lb

Sheet per lb.	— 10½@— 11

San Francisco Stock Market.

BY TELEGRAPH.

Our report from the San Francisco Stock Market is dated the 30th inst. The advices from New York last week, ordering heavy sales of some of the favorite mining securities, seems to have had but little effect upon the market, which, with but a few exceptions, still continues to advance. Per Associate Press advices, dated the 26th ult., Belcher was selling at $1550.00 per share which was an advance of $480 per share within three days, and this right in face of the doubt implied by the heavy orders to sell from our New York holders ; Eureka Grass Valley has declined just one half, since the 19th. The following is the report of the Board :

	April 19.	April 30.
Savage	600	600
Crown Point	—	1465
Yellow Jacket	269	275
Kentuck	520	460
Chollar Potosi	275	250
Gould & Curry	505	520
Belcher	1550	1400
Imperial	385	415
Hale & Norcross	400	—
Eureka G. V.	—	16¾
Ophir	107½	—
Alpha	182½	—
Raymond & Ely	119	—

Mining Stocks.

NEW YORK, May 1, 1872.

The condition of the Mining Stock Board remains almost unchanged. La-Crosse and Am. Flag seem to form the principal feature of interest, as far as the transactions of the Board are concerned, both of which items have considerably advanced. Ulster Coal and Iron is quoted at $13, and Evergreen Bluff "Lead" is quoted at from $3,00 to $5,00. The report is as follows :

	BID.	ASKED.
American Flag	50	55
Bates & Baxter	35	—
Benton	4	5
Black Hawk	—	1 50
Jasco Gold	—	—
Central Gold	12	—
Cons Gregory	50	59
Grass Valley	10	17
Gunnell	50	—
Holman	4	10
La Crosse	70	71
Liberty	—	—
Montana	—	—
Rocky Mount	13	15
Quartz Hill	42	50
Smith & Farm	45	90
Sexax	2	20
New York	—	1

Petroleum.

Petroleum is dull and unchanged. The following is the report of the Board.

	BID.	ASKED.
Bennehoff Run	20	30
Bergen Coal and Oil	—	40
Blood Farm	5	—
Bliven Oil	—	56
Brewvoort	1 50	3 00
Buchanan Farm	45	50
Central	50	—
Home	1 25	1 50
New York & Allegheny	1 25	—
Northern Light	30	—
Phillips Pet	5	15
Pithole Creek	—	1 00
Rathbone Oil	20	—
Rynd Farm	25	30
Second National	—	40
United Petroleum Farms	28	30
United States	35	55
Clinton	—	—
National	—	—
Sherman & B	—	—
Tarr Farm	—	—
Webster	—	—

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DEPARTMENT OF POPULAR SCIENCE.

THE CAISSON UNDER THE NEW YORK PIER OF THE EAST RIVER BRIDGE.

Every body who has heard of the great undertaking of connecting this city and Brooklyn, by means of a lofty suspension bridge, knows that the foundations for the piers are secured by means of caissons. The notions which many intelligent people, not accustomed to mechanical problems, entertain regarding the construction, manner of using, and the final disposition of the caisson are, however, erroneous; though the general plan of building and sinking a caisson is easy of comprehension. By the courtesy of Mr. F. COLLINGWOOD, one of the engineers in charge of the construction, we had full opportunity on a recent visit to examine the work now in progress on the New York pier. The results of this observation we will give, without going into the details of the construction of the caisson, describing the precise manner in which it was launched, or telling how many thousand bolts it contains; these facts are in themselves interesting, but the statement of hem has often served to cover the ignorance of writers in the daily press regarding the general principles on which the employment of the caisson, as a means of securing a foundation, rests.

The report of Chief Engineer W. A. ROEBLING, published in the *Engineering and Mining Journal* in June last, gives a full account of the manner in which the Brooklyn caisson was sunk, and of the difficulties encountered in the operation. The narrative of this report testifies the skill, pluck, and determination of the management, as well as an ability to solve rapidly, and under discouraging circumstances, problems involving immense sums of money, and danger to numerous human lives. Of these things it is not our intention at present to write. We purpose to give in plain terms such a description of the work as will render it intelligible to the general reader.

The caisson is essentially a wooden box, one hundred and seventy-two feet long, a hundred and two feet wide, and fourteen feet high, open at the bottom and closed at the top. It is built of heavy Georgia pine timber, firmly bolted together, and caulked to render it air tight. Strong cross partitions of timber, which are introduced to brace it, divide the rectangular box into smaller rectangular portions, and support the roof, which would otherwise have only the sides of the box to rest on.

We have said that this box is inverted, and we may add that in this position it is sunk in the river till it touches bottom. A simple experiment, which can be performed by anyone in a few minutes, will illustrate the fact that this can be done without filling the box with water. An empty tumbler may be inverted and sunk into a pail of water without being filled, provided only the precaution is taken to keep it vertical or nearly so. It will be seen, however, that though the tumbler is heavier than the water, and if full of water, will sink very rapidly to the bottom of the pail, still if it is kept in the position indicated considerable force will be required to bring it to the bottom and keep it there. It will be noticed also that the lower the position of the tumbler below the surface of the water, the greater the force required to sink it. Now the caisson is nothing, but a huge rectangular wooden tumbler, inverted, and sunk perpendicularly. The force employed to sink it is obtained by piling stones upon it, in the shape of masonry, destined to form a portion of the pier which is to be built. By putting on this masonry regularly, the caisson is kept from tilting up at either end; and if it should get a little higher at one end than at the other, an extra weight can easily be applied to bring it back to the proper position. In other words, if the masons at work on one end outstrip their comrades at the other, they have to wait for the latter to catch up.

To return to our experiment with the tumbler: if the tumbler be observed when it has reached the bottom of the pail of water, it will be found that though no air has escaped, a portion of the space near the rim of the tumbler is full of water. It is evident, therefore, that the pressure of the water, as we go below the surface, compressed the air in the tumbler, causing it to occupy less space than it did originally. Now, if we imagine the pail and tumbler sufficiently enlarged to contain a man, it is evident that if he stood on the bottom of the pail he would get his feet wet, and if we want him to work there in comfort, we must in some way expel the water. We could not pump it out without emptying the whole pail; for as fast as we pumped one gallon out another would run in. But we can easily solve the problem by forcing more air in at the top of the tumbler. If we apply force enough to the air, it will have to enter, and to make room for it the water will be compelled to depart. This is as sure as the old proposition that two bodies cannot occupy the same space at the same time.

This explanation will be sufficient to account for the presence of air compressors, and for the necessity of forcing air under pressure into the caissons. Of course the air will not go in of its own accord; and in order to keep the water out it is necessary to supply its place with something else. Air is cheap and abundant; it is necessary for the men in the caisson to have air to breathe; and, therefore, air is pumped in to drive the water out.

We said that the deeper the tumbler was forced below the surface of the water, the more force was required to keep it there. This is because the pressure of the water increases as we go down, and in order to displace an equal bulk of it at different depths, different amounts of power are required. The masonry which is added continually supplies the power necessary to sink the caisson; and a number of air compressors that were not required when the caisson had not reached so great a depth as it now has, are now in operation to keep out the water.

In one respect it is evident that the caisson must differ from the tumbler. There must be openings in it, through which air can be forced in, and others through which workmen can get in and out. For the former purpose all that is necessary is to insert wrought-iron pipes, which conduct the air from the compressors, and to provide them with valves, which can, at any time, be shut. The passages for the entrance and exit of workmen are necessarily so large that some method must be adopted to prevent the escape of too much air, which, as we have seen, is under considerable pressure in the caisson. For this purpose "air locks" have been provided. An air lock is a compartment, large enough to hold a dozen men comfortably, made of boiler-iron, having two doors of sufficient size to admit the passage of a man's body. One of these opens into the caisson, and the other upon the outer world. By means of a valve in an iron pipe compressed air from the caisson can be admitted into this chamber, so that by entering it, shutting the outer door, and turning on the air, the pressure will, in a few minutes, be as great in the lock as in the caisson, whereupon the door leading into the latter may be opened, and without any further trouble than that of crawling through a small hole, one stands in the caisson fifty-three feet below high water mark.

The only inconvenience which attends the descent into the caisson, is the pressure of the air upon the ear-drums as the valve is opened. The pain is quite sharp, but is instantly relieved by swallowing or tightly closing the mouth and nose and blowing; as an Irishman expressed it "by blowing your nose into your ear."

Once safely in the caisson, one is scarcely conscious of being under any more than ordinary pressure of the air. The men at work in the compartments, and the movements of the lights present a scene novel and somewhat alarming to the uninitiated. The pitch of the voice in speaking, is so changed that one would scarcely recognize that of his most intimate friend, or even his own.

The workmen are engaged in removing earth, etc. from beneath the sharp, iron-shod edges of the caisson, and facilitating its regular descent. The lack of a solid-rock foundation at the river bottom has rendered this process necessary; and it is continued until the bed rock is struck—an occurrence which has just been reported from the New York caisson. When all things are ready, the caisson will be filled with water, and the masonry of the towers will be continued to the desired height. The mud and sand indurating around the flaring sides of the caisson, will assist the vast superincumbent weight in maintaining its stability; and as the strain from the bridge cables is a vertical resultant, there will be no force greater than that of the wind to exert any side-thrust upon the structure. W. P. W.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. It is believed that several names of members and associates elected at the Bethlehem meeting in Aug., 1871, have been accidentally omitted by reason of the loss of a portion of the records of that meeting. Such persons, or their friends, are requested to communicate with the Secretary.

II. All members and associates who have not paid their dues are requested to do so at once, by sending in postal orders, or checks, or money, ten dollars to the Secretary.

All members and associates who pay their dues for each current year, strictly in advance, will have sent to their address, regularly and weekly, the ENGINEERING AND MINING JOURNAL, which is the organ of the Institute, and will contain the proceedings and transactions, and all important papers read before the Institute, and all notices of meetings. Back numbers cannot, as a general rule, be sent.

III. It is expected that the more important papers read before the Institute, and the debates thereon, will be published in annual or semi-annual volumes to which those members and associates will be entitled who have paid their dues.

IV. Authors of papers are requested to notify the Secretary in advance of the meetings, giving the subject and length of their papers. Attention is also called, in this connection, to Rules 12 and 13.

The annual meeting of the Institute will be held in the city of New York, commencing on Tuesday evening, May 21st, at 8 o'clock, in the Cooper Union Building, at the head of the Bowery.

A meeting of the Council will be held at the office of the ENGINEERING AND MINING JOURNAL on Tuesday afternoon, May 21, at three o'clock. Members of the Council will take notice that the office of the JOURNAL has been removed to 27 Park Place, corner of Church street.

Gold and Silver in the Red River Country.

Reports are current of remarkable discoveries of gold and silver in the Red River country. What they amount to, will scarcely be known for some time to come. We may expect during this summer to hear, if we hear anything, the usual alternation of glowing eulogy and disgusted depreciation, according to the interests or temperaments of those who originate the reports. At present the sanguine view predominates. "One of the oldest explorers of the Lake Superior region" is of opinion that the silver discoveries will go far to surpass the Silver Islet mines. Considering that Silver Islet is one of the half dozen richest deposits in the country, this prophecy is tolerably strong. Why is it that "old explorers" invariably tell the biggest stories, and seem to believe them, too? Possibly one reason is that nobody pursues that business steadily unless he is constitutionally hopeful. Hope, pork and beans are the sustenance of the race; and so all old professional prospectors are sanguine, because those who are not so give up the occupation or die young. We are not inclined to find fault with a peculiarity which lends so much power to the advance of civilization; and though we do not clearly see that promised rival of Silver Islet, we trust the pioneers who are pressing into the Red River country will not give up the search until they find their treasure or "know the reason why." It may comfort them to remember that there are many degrees between Silver Islet and "no pay;" and somewhere on that long scale, they may find a satisfactory, if not an incredibly gorgeous reward of their perseverance.

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D., Editor.

PUBLISHERS' ANNOUNCEMENT.

THE ENGINEERING AND MINING JOURNAL *is projected in the intent of furthering the best interests of the Engineering and Mining public, by giving wide circulation to original special contributions from the pens of the ablest men in the professions. The careful illustration of new machinery and engineering structures, together with a summary of mining news and market reports, will form a prominent feature of the publication.* It is the Organ of the American Institute of Mining Engineers, and is regularly received and read *by all the members and associates* of that large and powerful society, *the only one of the kind in this country.* It is therefore the best medium for advertising all kinds of machinery, tools and materials used by engineers or their employees.

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THE SCIENTIFIC PUBLISHING CO.

WILLIAM VENTZ, SECRETARY.

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To prevent recurrence of misunderstandings on the part of our patrons, we take occasion to repeat that the firm of WESTERN AND COMPANY, formerly publishers of the ENGINEERING AND MINING JOURNAL, no longer exists. One of the partners is dead; the firm has been dissolved, and the new firm of that name comprises only, of the former associates, Mr. BENJAMIN R. WESTERN, who is in no way, either as stockholder, editor, employee or agent, connected with the Scientific Publishing Company, now owning this Journal. This explicit statement is due to Mr. WESTERN as well as ourselves; and we trust it will serve to put an end to annoying mistakes, resulting from the identity of name between the two concerns, one of which is an entirely *extinct* affair, while the other is an entirely *distinct* affair.

We are now comfortably established in our new and pleasant offices at No. 27 Park Place, where we shall be glad to see our friends. The change is in all respects an agreeable one to us, and we trust our subscribers will perceive in the columns of the JOURNAL, the improvement resulting from greater quiet and convenience in the editorial sanctum and the counting-room.

Unfortunately, just as we were prepared to rejoice in our new surroundings, we are called upon to mourn the loss of our esteemed associate, Mr. WILLARD P. WARD, for more than two years an editor of this Journal. He departed this life—we mean this editorial life—very suddenly, last week, to our great affliction, though we have this comfort, that our loss is his gain. He is not dead, this young man of our affections, but gone West, with the Star of the Empire in his pocket. A loud call it was, and its echoes had the ring of shekels in them. Mr. WARD will *not* start another paper, as people who leave us are rather apt to do, but will devote himself to the active pursuit of his profession, in which his knowledge and judgment will make good his present flattering prospects. We have the promise of contributions from his pen, as some alleviation of our pain in losing him.

The Pennsylvania "Accidents."

THE mine-explosions in the Scranton district, particulars of which will be found in our Mining Summary, illustrate anew the necessity of discipline in our American coal mines. In both these cases, the explosion was caused by carrying naked lights—in one instance, contrary to express orders, and in the other instance, contrary to ordinary prudence—into fire-damp. The miners' league, which has had so much to say about the perils of the profession (as a reason for higher wages) would do well to provide for some feeble instruction of its members on matters which daily jeopard their lives. But no instruction will avail much, until discipline is enforced; by which we mean, that rules should be established, and every infraction of them should be promptly punished, *particularly if it does not result in an "accident."*

Our mines, as they grow deeper, become more and more dangerous, It is sheer idiocy for men to enter a coal mine, as seven men entered the Hampton mine last Friday week, with naked lights, after the works have been empty for five months. Yet if these men had come out safely, no notice would have been taken of their act, or of the reckless order of the mining captain who sent them in. Of course the mine Inspector will have much to say now; but safety is not to be secured by inspecting dead bodies, or by punishing criminal folly only when it ends in disaster.

The Fall of the Coliseum.

ON the 26th of April, the new Jubilee Coliseum in Boston was blown down. The managers immediately passed a vote of confidence in the architects and their plans, but, "for lack of time," ordered the reconstruction of the edifice on the pattern of the first coliseum, (we mean the Boston, not the Roman one) which did not fall. It is not possible to say, at this time, whether the plans of the ruined building were defective. Of course a vote of confidence, without other evidence, is less than nothing in their favor. But it should be borne in mind that the destruction of an unfinished building, particularly of a frame and truss plan, by a high wind, is not proof that the same building when completely put together, would be unable to resist all strains of weight or thrust. Engineers are well aware, in the analogous case of bridge-building, or the construction of dams, that the work in progress is not safe at every step against the natural forces of wind or tide. It is only when all parts are complete, and afford to each other the reciprocal support provided for by the design, that the anxiety of the engineer or architect is relieved, and his responsibility for the result of his calculations really begins. It should be added, however, that in a locality where heavy winds prevail (as is said to be the case with the site of the Boston Collapseum) their interference with the work of construction should be taken into account, and the choice of a plan should be controlled to some extent by that consideration.

The Giant Geyser.

THE New York artists are "painting the lily" in their pictures of Yellowstone scenery. We now have in *Appleton's Journal* a picture of the Giant Geyser, in erruption. An enormous crater looms up in the middle distance, out of which bursts a column of steam and water, while a frightened tourist runs away in the foreground. The engraver has made either the tourist several times too small, or the crater several times too large. On the other hand, he has scarcely done justice to the water business, which is the principal part of the exhibition.

A Mining Bureau.

We have received from Salt Lake City a circular o the American Bureau of Mining Information for Utah, with the compliments of E. M. BARNUM, Esq., Actuary and Secretary. The chief objects of this Bureau are declared to be, to gather reliable information and statistics relating to mineral locations and mining property throughout Utah, their extent, development and value; to obtain and preserve as complete a record as practicable of leading mines, mining companies, mills and furnaces, together with names of owners, amount of capital invested, extent of work and production; to investigate and report upon the character, development, title, richness and value of mines and mining property, which shall have been submitted for examination, and registered with the association; to furnish capitalists who seek information, reliable data and trustworthy evidences pertaining to location, titles, values, etc.; to advance the interests of worthy and legitimate mining enterprises, thus discouraging bogus and fraudulent operations; to gather and keep a cabinet of ores, specimens and other evidences of the mineral wealth of Utah; to establish in Salt Lake City a general office where parties seeking the purchase or sale of mines, may find facilities for acquiring certain and reliable information for mining transactions, and to furnish for publication reports upon mineral developments, productions and statistics of Utah.

By the By-laws, it is provided that all reports upon mineral property made by authority of the Bureau shall require the unanimous concurrence of the Executive Committee, or the approval of two-thirds of the full Board of Directors; that no Director shall take part in the examination of any mineral property or vote on the adoption of a report thereon, in which he holds an interest, and that no person shall be employed as an examiner, mining expert, engineer, assayer or otherwise, upon the investigation or examination of any property, wherein he has an interest.

These provisions are highly to be recommended; but we fear they will be found difficult to carry out in practice. Of the highly respectable gentlemen who organize this association we recognize several as largely interested in mining property in Utah. Some of them have sold a good deal, and have more left for sale. Suppose they violate their by-laws, has the possible sufferer any redress? Do they make themselves legally responsible in any way for the accuracy of their reports? But supposing that they conduct their operations with perfect fairness, each Director declaring frankly whenever he is an "interested" party, and magnanimously declining to vote on that account—as no doubt most of them would do—it is still a troublesome fact that all of them are indirectly interested, for the sake of the community, in encouraging the sale of property and bringing in capital. If they begin by condemning a few claims (and they will be tempted by conscience to condemn a good many) they will ruin their business.

We notice in the circular that the special reports of the Bureau are to be valuable *collateral* evidence for capitalists. This is a recognition of the fact that capitalists will not accept without verification any

reports not made explicitly and undoubtedly in their own interest. They will send their own expert agent to inquire whether things are as they are represented to be. But a simple vendor's statement is as good a basis for examination as any second report; and in this light the Bureau appears to be an unnecessary agency, increasing the cost of the transaction.

But if its reports are to have decisive value, it will be derived, not from the endorsement of a lot of eminent gentlemen sitting on a Board, but from the personal character and reputation of the experts employed. To say that no expert shall be employed who is interested in the property examined, is to promise a possible safeguard against fraud; but it protects nobody against inexperience, sanguine judgment or charlatanry. And if for each case a suitable choice is made, and the expert's report is authoritative, by virtue of his experience, knowledge and uprightness, then it is a ridiculous or a suspicious measure to require that a Board of Directors, not experts, shall debate upon it, and refuse to issue it unless it suits them.

We remember well enough the history of the American Bureau of Mines, established in this city some years ago, on a plan which was in some respects superior to this. In that case a Board of Experts, not business directors, passed upon the field-notes and made up the reports. Perhaps several causes contributed to the failure of that experiment; but one chief cause was the fact that capitalists wanted assistance in speculations rather than exact and unvarnished statements of fact; or when they really desired the simple facts, they cared nothing about the endorsement of a Board, but preferred to select their own agents upon personal knowledge and confidence. The same cause will operate against this part of the business of the Utah Bureau.

But the Bureau, energetically administered, may confer great benefit upon the Territory, by the collection of valuable information, statistics and specimens. It ought to become the headquarters of mining enterprise, the exchange, where professional and business men, strangers or citizens, interested in the mines or smelting works, can meet and confer. Nothing need prevent its exerting a strong and favorable influence upon the industry and the speculation of mining, except its relapse into the control of some "ring" of vendors which we trust will not occur.

About-Town Jottings.

BUSINESS AND PERSONAL.

Personal announcements and business notices inserted in this column, at fifty cents per line.

Root's Wrought Iron Sectional Boiler, manufactured by the Root Steam Engine Co., 500 to 510 Second Avenue, New York.

Geo. F. Blake & Co., 79 Liberty street, Steam Pumps of every size and capacity, for all purposes.

Utica Steam Engine Co. (formerly Wood & Mann Steam Engine Co.,) 42 Cortlandt street, N. Y.

Post & Goddard have removed to No. 111 Liberty street. Dealers in Taps, Dies, Reamers, Drills and supplies generally.

American Submerged Pump. Power attachment—cheapest and best in the market, 55 Chambers street, N. Y.

Roper Caloric or Hot Air Engine, 124 Chambers St.

Blake Bros., New Haven, Conn., manufacture Stone Breaker for crushing ores and minerals of every kind into small fragments, preparatory to their further comminution by other machinery.

Alabama's Resources.

REPORT ON IRON AND COAL MADE TO THE BOARD OF TRADE BY GEORGE N. STEWART, ESQ.

The committee charged with the interest of the city of Mobile in respect to the Mines and Minerals of the State, respectfully report:

That they respectfully refer to the previous report of this committee, in which they advanced the idea that the mines and mineral resources of the State would take care of themselves if the means of transportation to the seaboard were provided, and that the construction of the Grand Trunk Railroad was all that was wanted to give Mobile the benefit of the enormous productions which could and would be thereby made available and were unavailable for the want of this auxiliary aid. This it was which was wanted, and this it was which Mobile could supply. That work is in progress, but it is not yet completed.

These views are now reiterated, but under much more hopeful prospects than then, as the subject has manifestly attracted much more attention now, and the reason is, that the enormous value of these internal resources of the State is more widely known now than it was then.

When we say more widely known, we speak comparatively; for it is very little known even yet, and the public at large have still no information as to the real value of the coal and iron wealth of this State which has slumbered so long. It was no doubt the want of means of access to this mineral region, and the hopelessness of means of transportation, which has been the cause of this supineness; and it is only now, when railroads have become an available means of access, that this want of interest disappears. We must add to this, that this extraordinary source of wealth was either only related or published occasionally, when, although the truth was only half told, yet the public would not believe it, and supposed it was all fancy and exaggeration.

Now, however, we can boldly advance the truth, we have means of access so that all can see for themselves; we have the examinations of scientific men, of men who are skilled in mining operations, and also official reports, so that we can be safe in what we assert, and challenge contradiction.

We say that the capacity of Northern and Middle Alabama to produce for market coal and iron, is most extraordinary; that the supply is inexhaustible; that competition can be defied from every quarter, and every country; and that the attendant advantages and facilities for the development of these mineral productions are, we may say, unparalleled; and say it truly.

It is well known that there never can, in our generation, nor probably many others which are to follow, ever be an over supply of iron or coal for all the increasing wants of the civilized world; and moreover, these products are not like cotton and other agricultural articles, as to which the supply may come from many countries and thus exceed the public wants, because it is not every locality which can supply coal and iron; and although there may be many which can, yet localities, which present the most advantages combined, will take the lead necessarily, and that lead carries us to immense wealth.

How, then, stands the case with us.

Col. TAIT, the Commissioner of Industrial Resources of Alabama, an English gentleman of high standing as a geologist, mineralogist, and mining engineer, by his report to the Governor of the State of the present year, states the fact (well known to us, indeed, before,) that the area of coal lands of this State is, in round numbers, 5,500 square miles, known, respectively, as the Warrior, Cahaba, and Coosa coal fields. He says no language which he could employ could possibly do justice to the immense value of this great natural deposit of mineral wealth. He says five extensive seams of coal have by him, by actual observation, been traced to the surface and measured, lying near the leading railroad lines, besides others, showing an aggregate thickness of nineteen feet four inches, varying in thickness from 2½ to 5¾ feet. That, assuming this to be the limit of our coal strata, it would show an aggregate of nineteen millions of tons for every square mile; and estimating only one-half of the area to be productive, it would amount to fifty-two billions and two hundred and fifty millions of tons as the product of our coal fields; and further, he says: that if we were to attain to a mining capacity equal to the State of Pennsylvania at the present time, it would take two thousand years to exhaust the supply; but that we are not to suppose for a moment that this estimate, enormous as it appears, tells the whole story.

We have here seen only the layers which have appeared at the surface, and we can look at other countries to see what are the coal developments. The aggregate layers obtained by deeper penetration are, in Nova Scotia, forty-five feet; in Missouri upwards of fifty feet; in Kentucky nearly sixty feet. In Pennsylvania, where the coal measures are more deeply penetrated than in any other State, eighteen seams have been reached, showing a thickness of one hundred and twenty feet in the aggregate. In England and Wales more than fifty seams are at present known, the thickest one being of thirty feet; but this lies at a depth of two thousand feet. That coal can be found, in coal areas, as far down as mining operations have been carried on up to the present time, viz: three thousand feet below the surface. He says that experience teaches us that there are no limits to coal seams but the limits of attainable depth. The depth of the coal seams, however, in the Warrior coal field, is so inconsiderable that for centuries no deep excavation will be needed. We need say no more as to the extent of the supply.

What shall we say as to the value? We will give but two illustrations of this, cited by Colonel Tait. Mr. Simon Cameron, of Pennsylvania, about twenty years since, purchased a tract of land in that State, since which time coal has been discovered on it. For years past it has yielded him a revenue of $30,000 per annum. A mining Company in South Wales, England, are paying a yearly rent of $85,000 for the privilege of mining less than 200 acres of coal land, the depth of the seam being there between one and two thousand feet below the surface. As to the quality of the Alabama coal, it is similar in character to that of Pittsburgh; it is remarkably free from sulphur and also from iron pyrites, two qualities essential for steam navigation, and it is also perfectly suitable for use in iron furnaces, making gas, &c. The analysis of a specimen of coal from the Cahaba Valley is stated thus:

Volatile Combustible matter	36.68
Fixed carbon,	57.23
Ashes	5.30
Moisture	.79
Sulphur	A trace
	100.00

Specific gravity, 1.304.

Professor Tait after giving the estimates of the cost of mining the coal, which is here so accessible, remarks that if the mine proprietors would be content with 50 per cent. profit on their capital, there is no reason why coal from this section of country, and in the immediate neighborhood of the railway, should not be sold in Montgomery at $2.50 to $3.00 per ton, at the usual freights Mining, he says, however, requires skilled labor, and a thorough knowledge of the business.

Next, as to the iron. Here, we may again say that the means of supply will be inexhaustible; the iron region being vast, like that of the coal; the variety of ore great—red hematite, brown hematite, black band, fossiliferous, etc. One single locality may be mentioned—a ridge called the Red Mountain, with level valleys on both sides, extending from Jefferson county northeastwardly. This ridge contains a bed of red hematite iron ore of easy access, outcropping above the level of the valleys with a thickness, in places of thirty feet, with an average thickness of fifteen feet, and extending over one hundred miles in length. To say more, or to speak of the various other localities where iron furnaces are now springing up in this extended region, in every direction, would be useless. Let it suffice to say that iron ore exists in proportions of the same enormous magnitude as coal does.

We may admit that iron ore and coal do exist in other localities in quantities sufficient for all practical demands. It is not the enormous amount of ore alone which constitutes the supremacy of Alabama. It is the quantity, combined at the same time with the quality; the easy access; the immediate prxo-

imity of the coal and iron; the good quality of the coal,—the proximity of limestone used in reducing some descriptions of ore; the abundance of water power; the healthfulness of the country; free from ice, snow, or volcanic convulsions; abundance of provisions; of timber; the proximity to the sea, and valleys extending with the flow of the rivers without any grades of any consequence, by natural routes—by railroad and water flow—to the sea. All these advantages are found combined, we may assert, in a greater degree together here, probably, than in any other part of the world.

The ore is on the surface we may say, above the level of the railroads, and therefore requires no raising. It is accessible, and can be mined with pick and shovel. In quality, and richness of the ore, it is superior to that of England. The principal ores of England yield an average of thirty per cent. of metal, those of Alabama yield from forty to forty-five per cent. of iron. The quantity apparent on the Red Mountain of this red hematite ore, which requires no lime for smelting, would amount to more than a million of tons per mile, but to what great depth it extends in its dip, we cannot now determine. As to the quality of iron made from it, there is none known anywhere superior to it. This is now a well established fact. From this ore steel can be made by the BESSEMER process, and it is not all ores which will admit of this. It requires no aid by mixture with ores from abroad. In Pittsburg, large quantities of iron ores are imported from Michigan, on Lake Superior, to mix with the Pennsylvania ore, so as to produce certain qualities of iron. Ore is also imported there from the iron mountain of Missouri. Our ore requires nothing to improve it.

The transportation to the sea at Mobile is made easy by railroad on account of the very favorable nature of the surface of the country. The country of this mining district cannot be said to be mountaneous, it is, comparatively speaking, a very level one; at all events, the valleys point in the precise direction to Mobile, and are continuous; there is no high elevation to cross, no mountain ridges in the way.

The route of the Grand Trunk Railroad is the one designed by nature for the carrying of the great mass of mineral wealth to the sea.

TO BE CONTINUED.

MINING SUMMARY.

The San Francisco *Herald and Market Review* of April 19 has the following highly interesting quarterly mining review.

PROSPEROUS CONDITION OF THE MINING INTEREST.

The past three months have been signalized by an activity in everything pertaining to mining matters altogether unprecedented in the history of the business on this coast. Mining shares have advanced at a rapid rate, nearly every leading stock dealt in by the Board of Brokers having undergone a marked and, in some instances, most extraordinary appreciation. Production has been large and steady; investments free, and public confidence immeasurably increased in this branch of business.

Discovery, keeping pace with the new interest awakened in this calling, has pushed into unknown or little explored regions, and planted there the germs that will soon grow into sturdy communities, while inventive ingenuity, incited by the new demands made upon it, has contributed more than its ordinary complement of contrivances to aid production and economize expenditure. The antagonism between labor and capital has well nigh ceased, while legislation has succeeded in supplying certain deficiencies and in correcting some of the more glaring defects in our mining code. In short this pursuit, engrossing at length the attention of the thinking as well as the cupidity of the grasping, seems to have settled down upon a foundation broad, fixed and lasting; no more to be treated as a mere provincial thing, nor to be affected by temporary excitements and local disturbances. It has become national at last, and all begin to see in it that great and overshadowing industry that the sanguine had predicted and the trusting hoped would some day grow up on the shores of this far American Occident. Despite the disappointments and disasters that have heretofore so generally attended this business, the world is beginning to perceive what sources of illimitable wealth it is likely soon to supply, what new branches of trade it will engender, what new channels of commerce open up; stimulating and enriching wherever its influence may extend, if it do not realize all that the early Californian may have dreamed of the future. Mining is at last safe: it will be able hereafter to protect itself from financial convulsions, and even from the effects of its own oft-repeated mistakes.

The most noteworthy feature of mining operations during the past quarter has been

THE ADVANCEMENT IN SHARES.

of certain claims on the Comstock Lode, as well also as in those of a few mines elsewhere situated; this rise having been commenced in the preceding quarter and carried steadily forward since. The stocks that participated in it most largely consisted of the Crown Point, Belcher, and Savage, at Virginia; and the Raymond & Ely, in south-eastern Nevada. In the case of these companies, as well as of many others, this appreciation was based on the improved condition or appearance of the mines themselves, in some of which immense bodies of rich ore had been discovered, greatly enhancing their intrinsic value. In other instances, the prices of stocks and mining properties were advanced in consequence of the latter being on the same mineral belt with or in close proximity to the sites of these important discoveries; while, again, this result was due to "corners" effected by interested parties and other like means of questionable character. Apart from these direct agencies working to produce the above effect, the higher estimate set on mines generally has no doubt contributed something toward that end, causing nearly everything possessed of any recognized value to appreciate somewhat, in sympathy with the general advancement.

As a result of this appreciation of prices, shares in many companies have during the quarter been for the first time placed on the list of the Stock Exchange, greatly increasing the range of properties dealt in there. In this manner one mine after another has been added until nearly every one of our Pacific States and Territories finds itself represented on that list.

With this extraordinary activity in stocks and increased confidence in our mines,

THE PRODUCT OF BULLION

has also been large, notwithstanding the severe and stormy weather that has so generally prevailed. It is the opinion of many that for no corresponding period has so large an amount of gold and silver ever before been taken from our mines. The product of gold in California has been especially large, both our hydraulic and drift-diggings having yielded with a liberality never surpassed. Most encouraging are the accounts that come to us from this class of our placers, and there is little doubt but they are going to surprise all, except those best posted, by their out-turn the coming summer.

What with the discoveries constantly going on in the distant interior, the important developments recently made in our older mines, the improvements being introduced, and the economies effected in the extraction and reduction of ores, the ample water supply and the generally favorable out-look, the quantity of the precious metals likely to be gathered the incoming year is almost startling to contemplate. Six months ago we thought we had gone to the outer verge of probability in fixing the amount at seventy-five or eighty millions. Three months later, we ventured to suggest that it might reach a hundred, and now we are satisfied that it will largely exceed that figure.

INVESTMENTS AND ENTERPRISE.

With so much to attract it, capital from abroad has come to us freely, the investments on foreign account having been large—beyond example. Domestic capital is also beginning to embark freely in mining; even the most conservative and cautious of our moneyed men having come to regard this class of investments with favor. As a consequence, funds for legitimate operations in this direction are abundant, and a great many large and costly enterprises have been either inaugurated or projected. Some of these works are of a gigantic magnitude, nearly everything lately planned having been on a much more extensive scale than formely.

With capital and science, skilled labor has also come to our shores, enabling us, with the experience our own people have gained, to successfully combat the difficulties once so formidable in mining. The most obstinate ores are now treated to the satisfaction of both the mill-owner and the miner, being made to yield up a fair percentage of the precious metals they contain.

MAGNITUDE OF MINING OPERATIONS—EMPLOYMENT OF MORE POWERFUL MACHINERY AND IMPROVED METALLURGICAL PROCESSES.

Experience having indicated the economy of conducting mining operations on a large scale, there has been of late an increasing tendency toward the undertaking of extended enterprises and the introduction of more powerful agencies for reaching and breaking down the ores, as well as for their extraction and reduction afterward. Mills and furnaces of enlarged capacity are everywhere being erected. Aqueducts of imperial proportions, ground and elevated tramways, gigantic powder-blasts, mammoth nozzles, steam-drills, and a great variety of other new devices and more efficacious methods are being multiplied with a rapidity that keeps the business of mining in a state of almost constant revolution.

Helped on by these aids and improvements, obstacles that formerly interposed serious hindrances to mining enterprise, are now readily overcome, causing the timid capitalist to embark in schemes from which the boldest speculator shrunk but a few years ago, restrained by apprehension and doubt. The construction of a tunnel of but moderate length was then considered a very formidable undertaking, not more because of the cost, than the time required for carrying it to completion. With drilling-machines and giant powder, works of this kind are now contracted to be carried through in the course of a few months, and at scarcely more than half their former cost.

Recently, and for the first time on this coast, nozzles having capacity to discharge a thousand inches of water each, have been brought into use in hydraulic mining; this quantity being now played through a six-inch nozzle, and under the pressure of 460 feet, in the Roberts claim at Dutch Flat; and so well has Mr. E. B. DORSEY, the capable superintendent of that immense enterprise, become satisfied with the results of this experiment, that he intends soon to supersede these by eight-inch nozzles, capable of throwing two thousand inches of water each. Everywhere the plan of using water more freely in this class of operations is growing in favor, indicating the large demand that must soon spring up for this indispensible element, and the consequent and steadily increasing value that must hereafter attach to hydraulic works and franchises. Just now the most

ACTIVE FIELD OF MINING INDUSTRY

Is within the limits of our own State, the great abundance of water and other favorable conditions having here stimulated exertion to an unusual extent. Beginning as far south as Mariposa County, and extending thence to the northern limit of our gold-fields, we find the miners working with an industry not witnessed before for many years. At several points on

THE GREAT MOTHER LODE,

Which, commencing in Mariposa County, extends north for more than a hundred miles, operations, after a partial or entire suspension, are being resumed; and it will not be long until we shall see a general revival of this industry along the entire line of that vast and fertile, but long-neglected ore-channel.

On the Fremont estate and in the vicinity, more quartz will be raised and crushed this year than for some time before. Coming north on this great metalliferous belt, we find both the App and Heslep mines, after struggling for years, brought at last to a highly prosperous condition, showing that only depth is required to open up valuable bodies of ore in this channel. In what is known as the Dutch, or Silver claim, adjoining the Heslep, excellent prospects have lately been obtained, establishing for its property a more successful future and a high value.

Encouraged by these developments, measures have lately been set on foot looking to a resumption of labor on the Harris and on the Rawhide claims, lying on the Mother Vein a little farther north, and both of which are known to contain ores of almost fabulous richness.

Five miles farther on, we come to the rich group of claims on Carson Hill, a marvel of wealth and a wonder even in the early day. The history of this locality reads like a romance. But its opulence availed little to the men who first discovered and claimed it, every location having led to bloody strifes and endless litigation, which, having been prolonged through more than twenty years, wrested nearly every foot of this valuable property from the original contestants. The greater portion of it is now owned by a single party, who, during this long period of time, has been assiduously engaged in extinguishing the individual titles and gathering the ground up, until the whole has been aggregated in one magnificent estate, now placed beyond all controversy and question by a perfected United States patent. So far

as surface deposits may be accepted as indicating the character of those below, this is, presumably, the most valuable mining property in California; and the public will be gratified to know that, after having been tied up for so many years by litigation, these mines are soon to be worked on a scale commensurate with their apparent magnitude and early promise—Mr. Gabriel Stevenot, now chief owner and an old resident of Carson Hill, having enlisted capital to that end. It is matter of history that many tons of ore taken from these mines and brought to this city for reduction yielded all the way from $2,000 to $20,000 per ton. The sum of $3,000 per ton was paid for their treatment, this being in the early day, when enormous prices were charged for material and services of every kind, and the precious metals in these ores having occurred in the form of telluric gold and silver, rendering them extremely difficult of treatment.

From the developments being made on the Mother Lode, at points far apart, its great importance is every day becoming more apparent. In the App and Heslep mines, large bodies of good ore have lately been met with at the precise level on which the valuable ore-masses came in on the Hayward Mine at Sutter Creek—all of which are on this lode; and the impression is now beginning to prevail that when similar depths are reached elsewhere along it, equally good results will be obtained. Should this prove to be the case, we shall have, running centrally across our principal gold-field, an ore-bearing channel that will throw the Comstock Lode in the shade, inasmuch as the great California belt will probably prove equally as prolific, foot for foot, as that of Nevada, while the former will cover a linear extent more than fifty times greater than the latter. With this increased activity at Mariposa, the App, Heslep, and the Silver mines, and at Angels and the large and steady product of the Hayward Mine, and the prospect of an early resumption of operations on the Harris and Rawhide claims and at Carson Hill, and perhaps also at many other points along it, we may reasonably expect that important developments will be made on this great quartz reef during the current year, and that considerable portions of it will soon be placed in that condition of large and profitable production to which they should have been brought many years ago.

OTHER ACTIVE CAMPS AND LOCALITIES.

The revival of mining in this part of the State has not been confined to the Great Mother Lode, but has extended to many other camps and localities adjacent more particularly to those in the vicinity of Sutter Creek, Whisky Hill and West Point. In these several localities, much San Francisco capital is being embarked, and a number of promising enterprises have lately been inaugurated. Chief among these is the tunnel of the Ohio Consolidated Company at West Point, driven to develop a series of lodes lying near each other, and all of which paid generously when worked with arastras, hand-mortars, and other primitive appliances, in the early day. The exploratory work is being put forward with energy, to be followed in good time with mill, hoisting works, and other needed machinery. In the Aqueduct District, Amador County, a company, composed of nearly the same parties, is driving forward another important work, looking to the speedy opening up of the Norman Lode, another vein of fine promise.

Proceeding northward, we pass through many lively camps in Calaveras, Amador, and El Dorado Counties, till, having reached the divide between the Middle and North forks of the American River, we find here a very prosperous state of things, the mines all the way from Todd's Valley to Last Chance being worked with very remunerative results. Near the latter place the several drift claims now opened are paying with a steadiness and liberality never surpassed. These are about the most certain and satisfactory class of diggings in the State—some of them, such as the El Dorado, Yule, Evening Star, and the San Francisco grounds, being always good for handsome returns on a small investment.

At Todd's Valley, the Great Blue Gravel Range Company have just inducted an enterprise directed to the opening up and working of the old river bed at that place, and one, that, for the amount of money required to carry it through, recommends itself with peculiar force to capitalists. An expenditure of a few thousand dollars at this place will suffice to open and drain one of the most prolific of these ancient channels ever found in the State, and a large section of which this company has secured.

About Gold Run, Dutch Flat, Little York, Liberty Hill and You Bet, mining operations have expanded enormously during the past quarter, and were never in such a thrifty condition as at present. Farther north, on all the Yuba and Feather River divides, everything is being pushed, and the miners are doing well. Even up in the region of the deep snows, they are thus early commencing washing operations, and we may expect soon to hear of good clean-ups from the drift diggings in that quarter. Great things are promised us from the Slate Creek range of mines and the great gold-bearing channels to the east and north of it, this summer. Already from the extensive grounds of Conley & Co., and Brewster, and others about Laporte, liberal remittances are made; and we hear that the North America group of claims, at Hepsidam, Whisky Diggings, now owned in London, are being put in shape for spring operations, and that the most satisfactory results are likely to attend their future working. The management of this magnificent property has been committed to Mr. D. W. C. Morgan, a man as well qualified for the position as any we can think of, and we believe the company in securing his services, have the most complete guarantee that their mines will be ably and faithfully administered.

In other sections of the Pacific Cost, more especially in

THE STATE OF NEVADA,

we have also much activity in mining operations to note, with the promise of a very prosperous season before them. Despite the bad weather, the bullion production of many mines in that State has been large the past quarter. There was shipped from Virginia City, being the product of the Comstock mines, very nearly three million dollars during that time; and at the present rapid rates of increase, it is estimated that the yield of these mines for the current year will reach eighteen and possibly twenty million dollars. The Raymond & Ely is producing at the rate of nearly three millions annually, and a great many other camps and single mines are doing remarkably well, the Eureka District, in the matter of production, ranking just now next to the Raymond & Ely. In the latter district, there are a number of mines that are beginning to engross a large share of public attention, the most prominent in this category being the Meadow Valley and the Orient, both on the same ledge. The latter is a San Francisco company, lately incorporated, and owns what was formerly known as the Handy Andy ground, a property of large and established value. The company is financially strong and under a capital business administration, Judge Clapp—a man of intelligence, energy and large experience—having charge in the field.

FROM THE HUMBOLDT REGION,

extremely favorable reports continue to reach us. The Arazona Mine not only maintains but is likely to add to its steady well-earned reputation, the bullion product of the current promising to double that of the year just closed. From many other districts in that section, the accounts are equally flattering, the outlook in Golconda, Central Winnemucca, and other districts along that belt especially hopeful. In the Winnemucca District, many of the mines are looking remarkably well, it being a peculiarity of the lodes there, that, so far as opened, they exhibit the most satisfactory signs of richness and permanency. The Pride of the Mountain, the most extensively developed lode in the district, and, without doubt, one of the most valuable in northern Nevada, has just been purchased by a company composed wholly of our very best financial and business men, who will proceed at once to work it on a large and systematic scale. This property was bought on the judgement of I. M. Taylor, a mining engineer, having a long and successful experience and an expert of singular ability, and eminently discreet and cautious. Commanding ample capital, and having started right, this enterprise can hardly fail of achieving an early and marked success.

A POINT OF INTEREST.

Just at present, a good deal of interest is being awakened in mining circles, concerning the Schell Creek country, situate in central Nevada, and which is likely to draw a considerable population into it the coming summer. Already a great many promising claims have been located there, and companies are being formed and capital is beginning to embark pretty freely in schemes directing toward their developement. Thus a strong company has already been gotten up in this city for working the Great Western, the first lode located in the district, and probably the most valuable there, the ores running from $150 to 300 per ton, and very plentiful and easily mined, at that. Another institution, organized for operating in that region, consists of the Schell Creek Mining Company, also a San Francisco enterprise, made up of good material, and owning a great variety of valuable properties in the very centre of the district. This company owns the Monitor lode, a mine of large dimensions and enjoying a fine local reputation: they having also secured a large tract of land, well wooded and covering the principal town site, with road, mill and water privileges, and other franchises that impart to their estate a large value. The ores in this district are of uniform high grade and sufficiently free to admit of their being worked by ordinary mill process. The country contains much good land, is well supplied with wood and water, and of easy access from the Central Pacific Railroad.

Pennsylvania.

MINE EXPLOSIONS IN THE SCRANTON REGION.

Correspondence of the N. Y. *Times*.

SCRANTON, Penn., Friday, April 26, 1872.

This city was once more thrown into intense excitement this morning. The news of another fire-damp explosion at the Pine Brook Colliery spread with the rapidity of lightning. This colliery is considered the most dangerous, so far as sulphur is concerned, in the anthracite region, and the frequency of explosions sustains the opinion. This morning HENRY DAVIES, the fire-boss, went his usual rounds, and discovered the red and treacherous substance completely covering the roof of a new chamber lying directly under the Shopland-row, on Mifflin avenue, in the heart of the city. DAVIES thoroughly inspected the rest of the mine, his safety-lamp protecting him from explosion, and afterward ascended to notify the miners who were waiting for orders. Those employed in close proximity to the new chamber were told either to wait until MORGAN BOWEN, the inside boss, arrived, or go home for the day. It seems that DAVIES' orders were disobeyed. Five men descended the shaft and proceeded to the new chamber, four carrying safety-lamps, and one a naked lamp lighted and hooked on his cap. This man remained in the gangway, while the rest were "whipping out" the sulphur. Had he extinguished his light, there would have been no accident to record, but the moment that the "whipped out" sulphur from the new chamber came in contact with his naked lamp, a fearful and disastrous explosion ensued. No one was killed outright, but three of the five were so terribly burned that they are hourly expected to die. THOMAS O'HARA, THOMAS ALLEN and LARRY KARMIEN, miners, were frightfully burned on the face, back and hands. HENRY STRONG and DENNIS NELSON, laborers, luckily escaped with slight injury.

Mine Inspector P. BLEWITT held an investigation, according to the requirements of the Ventilation act. Such investigations have never yet amounted to anything more than a legal formality to place the fact on the State records. No verdict is rendered, and suggestions are hardly ever made to remedy defective legislation.

It appears that the men in the Pine Brook shaft were not thoroughly-experienced miners. They belong to the class who toward the end of the suspension last year went to work despite the intimidation of the miners, and thus broke up the suspension. They were employed then in the Briggs shaft, which, with the Pine Brook shaft, is owned by the Lackawanna Iron and Coal Company, JOSEPH H. SCRANTON, President, and were in the party led by WILLIAM WALKER SCRANTON, son of the President, from the Briggs shaft to their homes under protection of the military when the riot in which two Welsh miners were shot by one KEARNS, occurred. They were removed to the Pine Brook shaft, as it was not deemed safe for them to remain at the Briggs Mine, and the Company desiring to keep the men who had done so much for them. But the removal has been more fatal than the enmity of the miners could possibly have been, for the Pine Brook shaft is so dangerous that only first-class miners should enter it; and these comparatively unekilled men have melted away before fire-damp and other destructive agencies, mainly through their heedlessnes and disregard of instructions of mining bosses, until half of them are in their graves or maimed for life.

Another shocking mine explosion occured, between 7 and 8 o'clock this morning, at the Hampton Breaker, by which seven persons were frightfully burned and otherwise injured. The Hampton mine is situated in rear of Hyde Park, is the property of the Delaware, Lackawanna and Western Company, and one of the oldest and safest works in the valley. Five months ago the company ceased mining coal for the purpose of demolishing the rickety old breaker and erecting a new and more substantial one instead. The building is nearly completed, and men were engaged to-day for the first time, in repairing tracks and fixing props inside the mine preparatory to resuming the cutting of coal. There are about one dozen different gangways in this mine, running in all directions. Seven men were detailed to enter the gangway known as "The Dip." No person had entered it since the suspension of work, but no apprehension of the least danger existed among the miners, as there has

been but one fire-damp explosion since the mine was first opened. The seven men reached the heading of the gangway with their naked lamps, when the fire-damp exploded instantaneously with a terrific crash. So strong was the concussion, that three gangway doors, half a mile off, were shattered to atoms, and props knocked from their places.

The explosion was heard by men at work in other gangways, who hastened to the aid of their fellow-workmen. They found the entire party prostrated on the ground. JOHN REED, a road-layer, was found burned from head to foot, with his clothes ablaze. His recovery is impossible. Close by lay WATKIN H. WILLIAMS, with his skull fractured and a leg broken. He cannot recover. He has been a member of the General Council for several years. THOS. BARROW, the champion debater of the Hyde Park miners, was found lying in the water unconscious, and burned in a frighful manner. He is seventy years of age, and was contemplating retiring from the mines this Summer. The groans of WM. L. JONES brought the men to his aid. His face and arms were badly burned, but he is not fatally injured. WILLIAM MORGAN was not seriously burned, but received an ugly cut on the side of the head. MICHAEL CLARK, a laborer, managed to fall on his face, and escaped with a slight burn. THOS. GILGALLON fared worse, however, and now lies in a precarious condition, with the entire surface of his body burned.

The affair has cast a deep gloom over the many friends of the victims, and hundreds of miners are grouped on Main street, Hyde Park, this evening, expressing their sorrow. Notwithstanding this calamity work will be immediately resumed.

Pittston has also come in for a share of mining accidents. A fall of top coal injured Simon Jones, John Hinton, Michael Finnerty and Tom O'Malia. The two former were severely and the rest slightly injured.

ALFRED HALE'S leg was broken in the Bellevue shaft, to-day.

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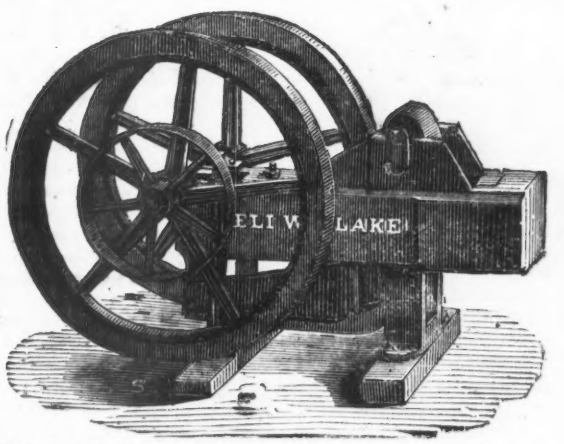

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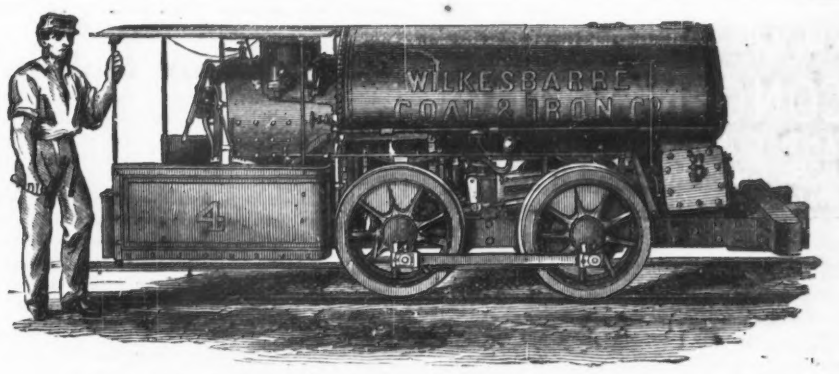

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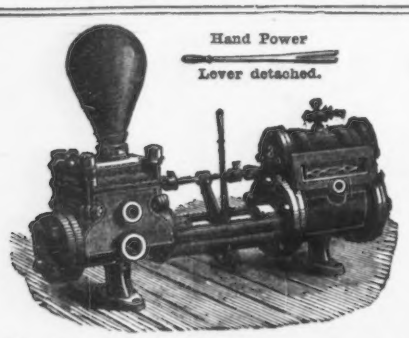

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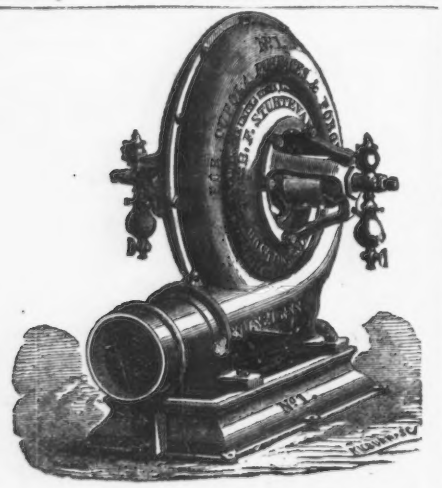

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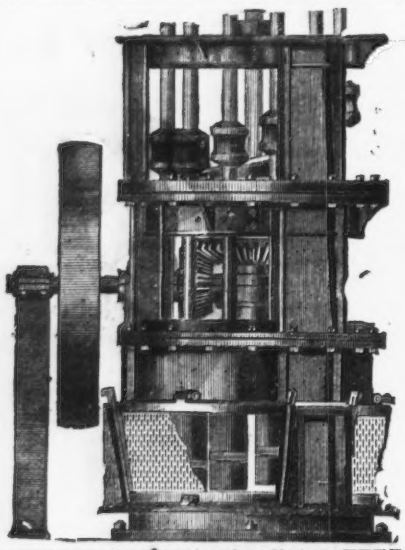

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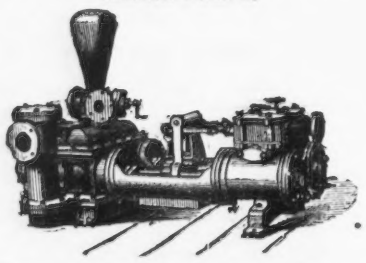

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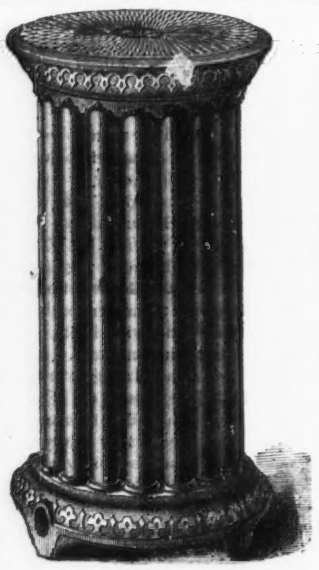

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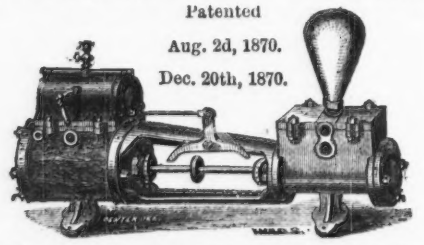

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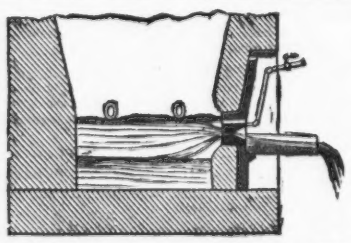

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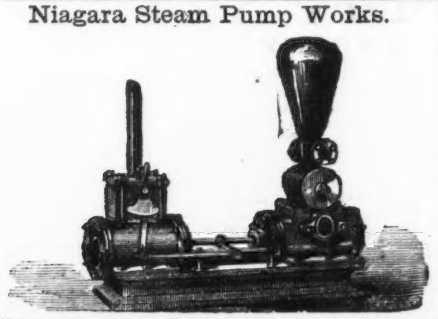

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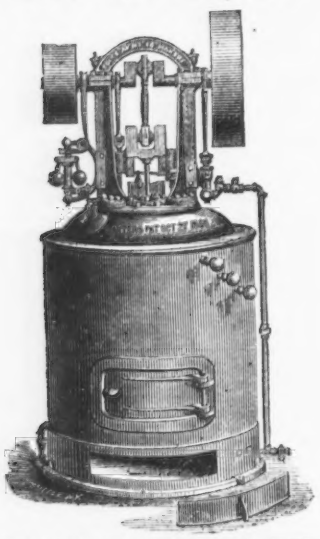

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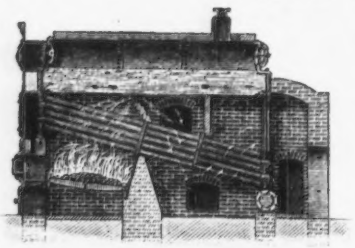

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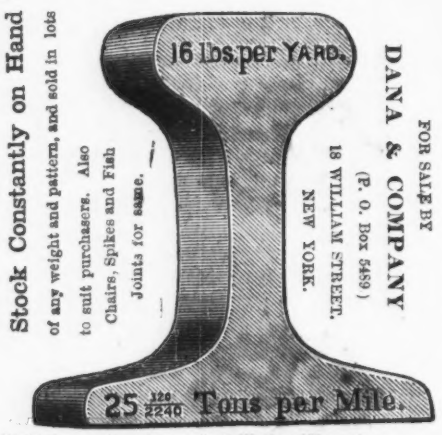

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